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1.0 INTRODUCTION & BACKGROUND

1.01 BACKGROUND, PURPOSE AND NEED

On December 5, 1997, the Albuquerque Area Office of the Bureau of Reclamation (Bureau), the Albuquerque District of the U.S. Army Corps of Engineers (Corps), and the New Mexico Ecological Services Office of the U.S. Fish and Wildlife Service (Service) began informal consultation pursuant to Section 7 of the Endangered Species Act (16 U.S.C. 1531 *et seq*, as amended) regarding potential effects of anticipated water operations and river maintenance activities on federally protected species in or near the Rio Chama and Rio Grande from Heron Reservoir and Velarde, New Mexico, respectively, downstream to the headwaters of Elephant Butte Reservoir over an approximate 5-year period. The Bureau and the Corps jointly submitted a Programmatic Biological Assessment to the Service in May 1998 (U.S. Department of the Interior and U.S. Department of the Army, 1998). A revised Programmatic Biological Assessment was submitted in October 1999 (U.S. Department of the Interior and U.S. Department of the Army, 1999). The primary federally protected species addressed were the Rio Grande silvery minnow and the Southwestern Willow Flycatcher.

On November 15, 1999, a coalition of environmental organizations – The Defenders of Wildlife, Forest Guardians, National Audubon Society, New Mexico Audubon Council, Sierra Club, and Southwestern Environmental Center – filed a lawsuit (*Rio Grande Silvery Minnow, et al,. vs. Eluid L. Martinez, et al.*) against the Bureau and the Corps for failure to comply with the Endangered Species Act regarding water operations and river maintenance activities. On April 10, 2000, in response to a much lower-than-average spring runoff in the Middle Rio Grande, environmental organizations filed a Motion for Preliminary Injunction to maintain flows in the Middle Rio Grande in a manner which would be sufficient to prevent the river from drying, particularly in the San Acacia reach, and to facilitate silvery minnow spawning. Defendant-Intervenors in the suit included the Middle Rio Grande Conservancy District, the State of New Mexico, and the City of Albuquerque. In lieu of an injunction, the U.S. District Court, District of New Mexico, ordered mediation amongst all parties which resulted in an Agreed Order, dated August 2, 2000, to resolve the plaintiff's motion in a manner that:

> "… (1) reduces the risk that conditions in the Middle Rio Grande Basin for the remainder of the year 2000 will lead to the extinction of the Rio Grande silvery minnow;
> (2) contributes to the long-term efforts to promote the continued existence and recovery of the silvery minnow and to avoid adverse modification of the minnow's designated critical habitat;
> (3) best addresses and protects the interests and needs of all interested parties in the Middle Rio Grande Valley;
> (4) recognizes hydrologic realities and the limited water supply that exists in the basin; and
> (5) is consistent with applicable provisions of New Mexico and federal law, and the relevant interstate compacts."

The Agreed Order provided for 85,900 acre-feet (ac-ft) of water to meet these objectives. Specifically included in this amount was 12,000 ac-ft from the sediment pool in Jemez Canyon Reservoir, a facility built and operated by the Corps. By the end of 2000, the Bureau, in cooperation with other entities, had obtained and provided in excess of 168,000 ac-ft of stored water to allow continuous flow in the middle Rio Grande for the silvery minnow and for irrigation purposes in 2000.

In a continuation of mediation to provide for water shortages during 2001, the State of New Mexico (New Mexico) and the United States of America (United States), acting through the Corps and Bureau have completed a Memorandum of Understanding (MOU), (Appendix C), to provide a limited amount of flow in the Rio Grande for the benefit of endangered species. The MOU outlines that the court-mediated efforts in combination with favorable precipitation during the fall of 2000 resulted in a 100,000 ac-ft addition to New Mexico's cumulative Rio Grande Compact credit in Elephant Butte Reservoir. New Mexico as a result, has proposed to make that credit water available for use by the United States for a period of three years, up to 103,000 ac-ft of New Mexico's native Rio Grande water and to establish a Middle Rio Grande Endangered Species Conservation Pool (Conservation Pool) in the Corps' upstream reservoirs. New Mexico proposes to make available for capture and storage in the Conservation Pool some of its native Rio Grande water during calendar years 2001 through 2003 at times when native Rio Grande flows are in excess of downstream legal entitlements, so that such water, if not stored, would have flowed downstream to Elephant Butte Reservoir and contributed to New Mexico's compact delivery.

Under the MOU, the Corps will seek to capture and store up to 103,000 ac-ft of native Rio Grande water at such times as the flows are in excess of downstream legal entitlements. Conservation Water stored pursuant to the MOU will remain under the control of the State of New Mexico, unless and until such water is made available for use by the United States pursuant a long-term agreement arising from further coordination. In the event that no long-term agreement is reached, the United States agrees that it will release the Conservation Water to the Rio Grande at times and in quantities specified by the State of New Mexico and pursuant to applicable laws and regulations. Reclamation will perform the hydrologic accounting for all reservoir operations. The MOU will expire on January 31, 2004.

Pursuant to the responsibilities of federal agencies under Section 7(a)(1) of the Endangered Species Act, the Corps has formulated plans for the establishment of a temporary conservation pool at Jemez Canyon and Abiquiu Reservoirs. The federal action evaluated in this Environmental Assessment entails the temporary storage of the aforementioned native water in Corps reservoirs and its subsequent release for the benefit of the Rio Grande silvery minnow. Non-emergency deviations to the existing water control plan at Corps reservoirs require approval by the South Pacific Division of the Corps. Pursuant to Engineer Regulation 1110-2-240, *Water Control Management*, deviations in the approved water control plans require compliance with the National Environmental Policy Act and all other appropriate laws and regulations. Under the criteria contained in PL 86-645, concurrence of Compact commissioners from Colorado, New Mexico, and Texas has been acquired for the proposed action.

1.02 LOCATION

The Abiquiu Dam and Reservoir Project is located on the Rio Chama about 32 river-miles upstream from its confluence with the Rio Grande near the city of Española, New Mexico. It is located approximately seven miles northwest of the village of Abiquiu, 30 miles northwest of Española, 60 miles northwest of Santa Fe, and 110 miles north of Albuquerque. The Abiquiu Dam and Reservoir Project is in Rio Arriba County and can be reached via U.S. Highway 84. New Mexico State Highway 96 leads to the project and crosses the dam (Figure 1).

The Jemez Canyon Dam and Reservoir Project is located on the Jemez River, 2.8 miles upstream from its confluence with the Rio Grande. It is situated in Sandoval County, about 5 miles northwest of Bernalillo, New Mexico, and about 22 miles north of Albuquerque (Figure 2).

1.03 PROJECT INFORMATION

1. Abiquiu Dam:

The Abiquiu Dam and Reservoir Project is authorized for flood control, sediment retention, water supply, and recreation purposes. Abiquiu Reservoir is one element of a comprehensive system of flood control features providing flood protection for the Rio Grande and its tributaries in New Mexico. It is also one of the facilities that collectively manages the water resources of New Mexico for irrigation, municipal water supply, recreation, and fish and wildlife conservation. Abiquiu Dam was authorized for construction by the Flood Control Act of 1948 (Public Law No. 80-858) and the Flood Control Act of 1950 (Public Law No. 81-516). Original authorized purposes for the dam and reservoir included flood control and sediment retention. The establishment of a conservation pool of about 200,000 ac-ft in 1983 created a 4,100-acre lake, expanding and improving the lake fishery and recreational opportunities.

Construction of Abiquiu Dam was initiated in 1956 and the project was completed and placed into operation in 1963 by the U.S. Army Corps of Engineers. The dam is a rolled earth-fill structure with a crest length of 1,800 feet, a crest width of 30 feet, and a bottom width of 2,000 feet. The top of the dam is at elevation 6,381 feet (NGVD) and approximately 341 feet above the streambed. The outlet works are located at the base of the embankment, within the left (north) abutment. They consist of an intake structure, 12-foot diameter tunnel (conduit) upstream of the bifurcated gate chamber, two service gates, and a terminal flip bucket. The 2,260-foot-long conduit (at invert elevation of 6060 feet) has a maximum release capacity of 8,200 cubic feet per second (cfs) at maximum pool level. The spillway is located about 4,000 feet north of the dam's left abutment and is uncontrolled. It is about 2,600 feet long, 68 feet wide at the bottom, and has a maximum depth of about 42 feet. Spillway crest elevation is 6,350 feet. The maximum reservoir pool is at elevation 6,374.7 feet, with the top of the flood control pool at 6283.5 feet (USACE 1995a).

The Abiquiu Dam and Reservoir Project is operated for flood and sediment control within the restrictions imposed by the Flood Control Act of 1960 (Public Law 86-645) and the Rio Grande Compact (Compact). Any deviation not deemed an emergency requires the concurrence by each of the Rio Grande Compact Commissioners (representatives of the states of Colorado, New Mexico and Texas). Under current operating procedures, normal flows and releases from El Vado Reservoir upstream are passed through Abiquiu Reservoir with little, if any, regulation. Maximum releases are restricted to 1,800 cfs, the maximum non-damaging capacity of the downstream channel (USACE 1995a).

Figure 1. Abiquiu Dam and Reservoir within the Rio Chama drainage, New Mexico.

Figure 2. Jemez Canyon Dam and Reservoir within the Jemez River drainage, New Mexico.

When flows into the reservoir exceed the capacity of the Rio Chama downstream from the dam, or when flows in the Rio Grande equal or exceed its channel capacity, flood control storage is initiated in Abiquiu Reservoir. Flood waters are stored in the reservoir's 502,000 ac-ft allocated flood-control space. Operation of Abiquiu Dam for flood control is coordinated with Cochiti, Galisteo, and Jemez Canyon Dams. Flood storage can be expected from April through June. Flood storage is generally the result of snowmelt in the upper watershed. The maximum water storage to date has been 402,258 ac-ft (elevation 6,261 feet) which occurred in 1987. This volume included water from the San Juan-Chama Project and flood control storage (215,000 ac-ft. Congress passed Public Law 97-140 in 1981 authorizing the Corps of Engineers ".... to enter into agreements with entities which have contracted with the Secretary of the Interior for water from the San Juan-Chama Project pursuant to Public Law 87-483 for storage of a total of 200,000 ac-ft of such water in Abiquiu Reservoir." This approximate volume of water (to elevation 6,220 feet) is stored within the flood control pool and the unused portion of the sediment reserve.

2. Jemez Canyon Dam

Congressional authority for the construction of Jemez Canyon Dam is contained in the Flood Control Acts of 1948 (P.L. 80-858) and 1950 (P.L. 81-516). The facility regulates Jemez River flows for flood damage reduction and sediment retention. Construction of the dam began in May 1950, and it was completed and placed into operation in October 1953.

All lands associated with the Jemez Canyon Dam and Reservoir Project (about 6,711 acres) are held in trust by the United States for the benefit and use of the Pueblo of Santa Ana. The Department of the Army and the Pueblo signed an MOU in 1952 (amended in 1978 by P.L. 95-498) which established a perpetual right and privilege for the construction, operation, and maintenance of the Jemez Canyon Dam and Reservoir Project. The Pueblo of Santa Ana reserved the right to use all associated lands for any purposes not inconsistent with those expressly granted to the government for the facility.

The dam is a rolled earth-fill structure with a crest length of 861 feet and a crest width of 23 feet. The project was modified in 1987 as the result of revised probable maximum precipitation data and included raising the dam approximately 14 feet and widening the spillway 28 feet. Part of the dam raise included a 3-foot-tall concrete parapet wall at the upstream edge of the embankment crest to provide freeboard and control wave action.

Top-of-dam elevation is 5,271.6 feet (NGVD), which is approximately 149 feet above the original streambed. The outlet works are located in the left abutment and consist of an intake structure, modified 13-foot-diameter circular conduit, and stilling basin. The intake structure is a wet well tower with upstream trash rack, two gated openings, and operating deck at elevation 5,252.5 feet. Intake floor elevation is 5,125 feet. The modified circular conduit is 13 feet in diameter and 596.5 feet long, with a slope of 0.01676. The stilling basin is 80 feet wide and 70 feet long, with a level floor at an elevation of 5,076 feet. There are two rows of 3-foot-tall baffle blocks spaced 6 feet on center. The end sill is a 3-foot wall with a crest elevation of 5,079 feet. Capacity at maximum water surface is 9,700 cfs. An emergency spillway is located in a natural saddle about one-half mile south of the dam. It is 428 feet wide with 1 (vertical) on 2 (horizontal) side slopes and is approximately 3,900 feet long with a bottom elevation of 5,220 feet. Control is provided by a concrete ogee weir 50 feet wide with a crest elevation at 5,232 feet.

The reservoir at spillway crest (elevation 5,232 feet) is about 6 miles long and 1 mile wide. Initial capacity allocations were 73,000 acre-feet for flood control and 44,000 acre-feet for sediment deposition. Table 1 shows the area and capacity for initial conditions and subsequent surveys.

Table 1. Changes in Jemez Canyon Reservoir area and capacity.

		Original		1975		1983		1991	
Feature	Elevation (ft., NGVD)	Area (ac.)	Capacity (ac-ft)	Area (ac.)	Capacity (ac-ft)	Area (ac.)	Capacity (ac-ft)	Area (ac.)	Capacity (ac-ft)
Top of Dam	5257.5	4440	210,082	4373	198,200	4373	194,800	4373	192,573
Max. Water Surface Spillway Crest	5252.3	4147	187,752	4062	176,200	4062	172,800	4062	170,615

5232.0	2895	117,213	2877	106,100	2870	102,700	2954	100,485

Note: Some data represent pre-dam modification conditions.

Jemez River flows are passed through Jemez Canyon Dam with little, if any, regulation. Reservoir releases are restricted to the maximum non-damaging capacity of the downstream channel of the Rio Grande, as measured at Albuquerque, up to 7,000 cfs (USACE 1994). When the passage of inflow to the reservoir would exceed the channel capacity of the Rio Grande downstream, flood control storage is initiated. Flood waters are stored only for the duration needed to evacuate the water as rapidly as downstream conditions permit. Operation of Jemez Canyon Dam for flood control is coordinated with Cochiti and Galisteo Dams in order to regulate for the maximum safe flow at Albuquerque.

Flood storage is normally associated with snowmelt runoff during April through June. Summer flood storage is generally the result of short-term, high intensity thunderstorm events. The maximum storage to date has been 72,254 acre-feet (elevation 5,220.3 feet), occurring in 1987.

In the spring of 1979, the Corps and the New Mexico Interstate Stream Commission (NMISC) established a sediment retention pool of about 2,000 acre-feet at Jemez Canyon Reservoir using water exchanged from the San Juan-Chama Project. In January 1986 the sediment retention pool was expanded to include the entire unused capacity of the allocated sediment space to further improve trap efficiency of the reservoir. The water for this expansion (a maximum storage of about 24,425 acre-feet) was again obtained through exchange for water currently at the San Juan-Chama Project leased from the City of Albuquerque by the NMISC. The pool was created and maintained by capturing native water from the Jemez River in the reservoir and replacing that water to the Rio Grande by releasing San Juan-Chama Project water from upstream storage, usually during the spring runoff period.

The Memorandum of Understanding between the NMISC and the Corps concerning the establishment and maintenance of the sediment pool expired on December 31, 2000. Prior to the MOU's expiration and pursuant to the Agreed Order in the *Martinez v. minnow* litigation previously discussed, approximately 12,000 ac-ft of the water in the Jemez Canyon Reservoir sediment pool was released for the benefit of the Rio Grande silvery minnow in September through October, 2001 (USACE 2000b). As of early April 2001, approximately 4,000 ac-ft of the sediment pool water remains in storage and is expected to be evacuated later in the year.

1.04 REGULATORY COMPLIANCE

This Environmental Assessment (EA) was prepared by the U.S. Army Corps of Engineers, Albuquerque District in compliance with all applicable Federal statutes, regulations, and Executive Orders, including, but not limited to, the following:

National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. 4321 *et seq*.);
Regulations for Implementing the Procedural Provisions of NEPA (40 CFR 1500 *et seq*.);
Clean Water Act of 1977, as amended (33 U.S.C. 1251 *et seq*.);
Clean Air Act, as amended (42 U.S.C. 7609);
Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq*.);
Fish and Wildlife Coordination Act (16 U.S.C. 661 *et seq*.);
Floodplain Management (Executive Order 11988);
Protection of Wetlands (Executive Order 11990);
National Historic Preservation Act of 1966, as amended (16 U.S.C. 470a *et seq*.);
Protection of Historic and Cultural Properties (36 CFR 800 *et seq*.);
Government-to-Government Relations with Native American Tribal Governments (Memorandum from the President of the U.S., April 29, 1994); and
Protection and Enhancement of the Cultural Environment (Executive Order 11593).

Compliance with applicable State of New Mexico regulations and standards for water quality, and regulations conserving endangered plants and animals is also reflected in this EA

1.05 ENVIRONMENTAL DOCUMENTS INCORPORATED BY REFERENCE

The following environmental documents are incorporated by reference:

(1) *Abiquiu Dam and Reservoir Installation of Emergency Gates, Finding of No Significant Impact and Environmental Assessment*, October, 1996 (USACE 1996). This record documented the environmental effects of the emergency gate installation and associated reservoir and river fluctuations.

(2) *Amendment To Finding of No Significant Impact (FONSI) and Environmental Assessment, Abiquiu Dam and Reservoir, Installation of Emergency Gates*, May 1999 (USACE 1999). This amendment added testing of the emergency gates at various flow regimes to the aforementioned EA.

(3) *Abiquiu Dam and Reservoir, Emergency Gate Installation Inspection, Finding of No Significant Impact and Environmental Assessment*, July 2000 (USACE 2000a). This record documented the environmental effects of the emergency gate installation inspection that was required after gate leakage was discovered.

(4) *Finding of No Significant Impact and Environmental Assessment, Partial Evacuation of the Sediment Pool at Jemez Canyon Reservoir, Sandoval County, New Mexico*, September 2000 (USACE 2000b). This document evaluated the environmental effects of draining the sediment pool and effects on the upstream and downstream Jemez River environment.

(5) *Final Rio Grande Supplemental Water Programmatic Environmental Assessment*, March 2001 (USBR 2001) This assessment of the Bureau's Supplemental Water Program to benefit the silvery minnow evaluated effects for a five year program. All of these documents provide background data and analyses of environmental effects of flow fluctuations similar to those proposed for this environmental assessment and are referenced to avoid unnecessary duplication of effort.

1.06 RELATED ACTIONS

As of early April 2001, approximately 4,000 acre-feet of San Juan-Chama Project water stored comprising the sediment retention pool at Jemez Canyon Reservoir remains in storage. At the expiration of the storage MOU, ownership of this water reverted to the City of Albuquerque (City), and is available for release at the City's request. Neither the proposed nor no-action alternatives evaluated in this Environmental Assessment would affect the release of City water.

In anticipation of the termination of the sediment retention pool at Jemez Canyon Reservoir, the Corps and the Pueblo of Santa Ana (Santa Ana), have undertaken extensive studies to determine potential impacts of that action and to formulate appropriate mitigative actions. Both the Corps and Santa Ana consider the proposed storage evaluated in this Environmental Assessment as beneficial to those objectives. The resumption of former water levels in the reservoir, even temporarily, would facilitate ongoing studies and would delay potential impacts.

Five federal agencies with natural resources responsibilities relative to managing the waters of the Rio Grande (Corps, Reclamation, U.S. Fish and Wildlife Service, Bureau of Indian Affairs and U.S. Geological Survey) signed a Memorandum of Understanding for the development of the Upper Rio Grande Water Operations Model. This interagency effort is purposed to create a decision-making tool to address contemporary water management needs, including ecosystem health and diversity, and will provide for enhanced system management.

2.0 DESCRIPTIONS OF ALTERNATIVES

2.01 NO-ACTION

Under no-action, the storage of native Rio Grande water and delivery from an established conservation pool at a later date to benefit the Rio Grande silvery minnow would not occur.

The Riverware-based model developed by the Upper Rio Grande Water Operations Modeling (URGWOM) Team was used to aid in visualizing and evaluating both the no-action alternative and the proposed action. Under no-action, the Corps would not store any native water in Abiquiu or Jemez Canyon Reservoirs. The Corps reservoirs would be operated to pass inflow up to channel capacity. Given the average runoff conditions predicted for 2001 snowmelt runoff, modeling results show that the Corps could pass the natural inflow hydrograph at each of its projects. The peak discharges from Jemez Canyon and Abiquiu Dams would be approximately 1,000 and 1,800 cfs, respectively. The model results for no action include reservoir storage, inflow, outflow and stream flow predictions. Figures 3 through 5 show the forecasted operations. For the model runs, the Middle Rio Grande Conservancy District (MRGCD) irrigation demand was estimated from the previous years. Figure 5 shows that below Isleta and San Acacia Diversions, the flow could reach zero cfs. The modeling results are only estimates. Isleta and San Acacia normally have some flow that bypasses the diversions. The potential for river drying does exist under no-action. Results from the modeling effort show that in an average snowmelt runoff year with high monsoon thunderstorm activity, there is enough to keep the river wet. Therefore, zero flows do not occur at San Acacia with this operation scenario.

Figure 3.

Figure 4.

Figure 5

2.02 PROPOSED ACTION

The proposed action is storage of native flows in Abiquiu and Jemez Canyon Reservoirs and its subsequent release into the main stem Rio Grande for the benefit of Rio Grande silvery minnow, beginning with the spring runoff period approximately April 2001, and thereafter. As outlined in the aforementioned MOU, the State of New Mexico will make available for the benefit of the Rio Grande silvery minnow (RGSM), through sale, a portion of its Rio Grande Compact accumulated credit water stored in Elephant Butte Reservoir, by moving that water into upstream storage in Abiquiu and Jemez Canyon Reservoirs through exchange and establishing a temporary conservation pool. The water would be stored when native flows exceed downstream demands. Storage at Jemez Canyon and Abiquiu Reservoirs would begin April 13th. Jemez Canyon Reservoir storage would be limited to the top of the sediment storage space (elevation 5,197). Storage at Abiquiu would be limited by the available amount of runoff and not exceed a total pool volume of 183,381 acre-feet. The Abiquiu and Jemez Canyon Dam releases would be limited to 150 and 20 cfs respectively during the time period when excess flows are being stored. The release rates could increase in order to meet demand but would not drop below the target rates. The amount of water available for release for silvery minnow purposes would be approximately 30,000 acre-feet in a given year. The amount of water in excess to demand that could be stored in Jemez Canyon is approximately 20,000 acre-feet and at Abiquiu that amount is approximately 50,000 acre-feet. At Jemez Canyon Reservoir, 14,000 ac-ft of the stored water would be used as supplemental water, and the remaining 6,000 ac-ft would be used to provide a spike release. Release of the stored supplemental water would start in late June or early July, and continue through the end of the irrigation season. The volume released from Abiquiu and Jemez Canyon Reservoirs would be proportional to the amount of supplemental water stored in each reservoir. Preliminary estimates show that the target release would be made up of a release of 20 cfs from Jemez Canyon and 80 cfs from Abiquiu.

A supplemental spike release of approximately 5,200 cfs will be released in late May for two to five days to accommodate movement of sediment as a part of habitat restoration construction activities by the Bureau and Santa Ana along the Rio Grande just downstream from the Jemez River confluence.

The model results showing forecasted operations for the proposed action, including reservoir storage (including supplemental water), inflow, outflow and stream flow predictions are shown in Figures 6 through 8

In the event that the Settlement Proposal is not executed prior to June 30, 2001, the Corps will release the stored water to the Rio Grande between November 1, 2001, and March 1, 2002, at times and in quantities as negotiated between the Corps and NMISC in consultation with the U.S. Fish and Wildlife Service.

The Corps may evacuate the described conservation storage (native water) or any portion thereof as necessary for flood control purposes, in accordance with authorized project purposes. The Corps further reserves the right to take such measures as may be necessary to preserve life and property, including being able to meet emergency situations or to permit maintenance or repair of the dam or appurtenant structures. Regulation and releases will be accomplished with the Corps service gates and the Corps will not be liable or responsible for any loss of the stored waters due to any malfunction of the service gates or inspection and maintenance of the gates that may be necessary to assure the proper and safe operation of the project.

Figure 6.

Figure 7.

Figure 8.

3.0. ENVIRONMENTAL SETTING AND FORESEEABLE EFFECTS OF THE PLANNED ACTION

3.01 SCOPE OF FORESEEABLE EFFECTS OF THE PLANNED ACTION

Analysis of effects of the planned action included potential impacts of flow reductions during storage, flow increases during supplemental water delivery, flow increases due to spike flow delivery to provide for sediment transportation for habitat restoration, and reservoir pool fluctuations, to areas from Abiquiu Reservoir and Dam downstream on the Rio Chama, from Jemez Canyon Dam and Reservoir downstream on the Jemez River, and the Rio Grande from the Rio Chama confluence to the headwaters of Elephant Butte Reservoir. This Environmental Assessment analyzed the flow characteristics on riverine resources and reservoir pool characteristics associated with the no action and proposed action alternatives over a three year period ending January 31, 2004.

3.02 GENERAL OVERVIEW

The following description of the environmental setting on which to base the determination of effects is derived primarily from the *Abiquiu Dam and Reservoir Installation of Emergency Gates, Finding of No Significant Impact and Environmental Assessment, October, 1996* (USACE 1996). This document provides a comprehensive overview of the environmental conditions within the proposed action impact area. In addition, the *Amendment To Finding of No Significant Impact (FONSI) and Environmental Assessment, Abiquiu Dam and Reservoir, Installation of Emergency Gates, May, 1999,* (USACE 1999), and the *Abiquiu Dam and Reservoir, Emergency Gate Installation Inspection, Finding of No Significant Impact and Environmental Assessment, July 2000* (USACE 2000a), provide additional background information for flow variations on the Rio Chama due to gate testing at various flow rates. Additional information on Jemez Canyon Reservoir and the Jemez River was obtained from the *Finding of No Significant Impact and Environmental Assessment, Partial Evacuation of the Sediment Pool at Jemez Canyon Reservoir, Sandoval County, New Mexico, September 2000* (USACE 2000b). Resources discussed in this section are those identified in laws, regulations, guidelines, or other institutional standards; those that would be affected by the planned action; and those that would aid the reviewer in understanding the ecosystem in which the project is located.

3.03 PHYSIOGRAPHY AND CLIMATE

Diverse land forms and features characterize the general Abiquiu area: steep, narrow canyons; rocky foothills; broad valleys; vertical cliffs; gently sloping mesas; river; agriculturally dominated floodplain; and riparian cottonwood forest. Pinyon-juniper woodland characterizes the upland with areas of grassland and sagebrush on flat to gently sloping plains. The Rio Chama is sharply constricted just above the dam by a deep and narrow canyon, which extends about three miles below the dam. From this point, the canyon opens into a wide floodplain dominated by agricultural, for the remaining 29 miles before meeting the Rio Grande. Relief varies from about 6,000 to near 10,000 feet.

The climate of the Abiquiu area is semi-arid. Annual precipitation ranges from about 10 to 12 inches, the majority occurring in the form of summer thunderstorms. The mean annual precipitation at the project site is 9.65 inches for the 1958 to 1985 period of record. On the average, half of the annual precipitation falls in the months of July, August, and September. The mean annual temperature at Española is 51°F.

3.04 DAM SITE GEOLOGY

The Abiquiu Dam site is located in a canyon that is approximately 350 feet deep, varying in width from 300 feet at streambed level to 1,500 feet at the mesa. The site is about one mile downstream from the head of the canyon. Upstream from the head of the canyon, the reservoir area is a wide valley eroded in soft shales and mudstones of Middle Triassic age. At the dam site, the abutment slopes range from nearly vertical sandstone ledges and cliffs, to moderately sloping talus or overburden slopes. The deep canyon is eroded through hard, resistant Poleo sandstone of Lower Triassic age and Abo sandstones and mudstones of Permian age. In the streambed area, bedrock is covered by an average 20-foot thickness of streambed alluvium (silty sand and gravel). Overburden on the abutments consisted of slope wash, slump material, and talus, averaging about 50 feet in thickness. Bedrock in the upper slopes of the abutments is massive sandstone; the lower slopes and streambed area are interbedded sandstone and mudstone. The outlet works in the left abutment are in the Abo mudstone; the access shaft penetrates the full abutment section. The unlined spillway is excavated in the Poleo sandstone. The abutment and streambed mudstones are dense, well consolidated, and relatively impervious. The sandstones are a source of leakage due to

open fractures, cracks, joints, and bedding planes. The fill material placed in the waste disposal site consists primarily of sandstone rocks and soil.

As stated, water seepage through the north and south abutments of Abiquiu Dam increased significantly because of several years of record flood control storage and substantial carry-over storage above normal storage volumes. This increased water seepage contributed to the instability of the canyon walls immediately downstream of the embankment. This instability caused talus rock to fall and damage the outlet structure. Measures have been taken to remove much of the unstable rock of the canyon wall above the outlet works. In addition to causing the downstream canyon wall to become unstable, the increased seepage could overload the downstream internal drainage blanket, thus resulting in the downstream slope of the embankment to become saturated and unstable. Because of the seepage problem and possible instability problems that could occur with higher pool levels, possibly restricting the authorized purposes of the project, measures to control seepage from the embankment abutments were taken. These measures consisted of constructing a concrete-lined drainage adit (tunnel) into each abutment. These adits intercept and concentrate seepage which is then discharged into the Rio Chama downstream of the embankment. The adits were completed in April 1990.

The Jemez Canyon Dam and Reservoir are located entirely within an outcrop of the Santa Fe formation, a Miocene-Pliocene series of the Tertiary system. In the immediate area of the dam and well above the dam height, the Santa Fe formation is overlain unconformably by a basalt cap of Quaternary age. Within the reservoir area there is a minimal amount of basalt talus. The Santa Fe formation is composed of clay, silt, sand, gravel, and cobbles. The formation at the site is generally horizontally bedded; however, the beds are discontinuous both vertically and horizontally. Bank storage due to impoundment occurs within the Santa Fe formation or the overlying Quaternary sediments, primarily sand and gravel. A series of north-south trending faults about three-quarters of a mile apart can be observed in the basalt cap in the vicinity of the dam. A fault strikes across the dam axis from just downstream of the right abutment and appears just upstream of the left abutment. Displacement in the Santa Fe formation is not readily discernible because of the unconsolidated character of the formation. Faulting in unconsolidated or poorly consolidated and discontinuous lenses leaves no significant change in the material as would occur in bedrock. There is no record of recent seismic activity in the area.

The Jemez Canyon Dam is located across a constriction of a canyon cut by the Jemez River about two miles above its confluence with the Rio Grande. The canyon is about 250 feet wide at stream level and 1,100 feet wide at the crest. The depth of the canyon is about 275 feet at the left abutment, and 325 feet at the right abutment. Immediately upstream of the dam the valley widens considerably.

3.05 WATER QUALITY

a. New Mexico Water Quality Standards. The quality of water flowing into Abiquiu Reservoir, within the reservoir, and outflow from the reservoir, generally meets or exceeds applicable New Mexico Water Quality Standards. Abiquiu Reservoir has been characterized as mesotrophic (characterized by a moderate level of biological productivity) with moderately high and widely varying levels of nutrients and a moderate level of primary productivity (Barton and Johnson 1978). There is little, or weak, thermal stratification, and seasonal turnover is rare, if it occurs at all. Turbidity within the reservoir ranges from high near the headwaters, to minimal near the dam. Designated uses are irrigation storage, livestock and wildlife watering, primary contact recreation, coldwater fishery, and warm water fishery.

Water released from the low level intake at Abiquiu Dam is cold, low in nutrients, and low in fecal coliform bacteria. Outflows may be clear or turbid, depending on quality of inflow to the reservoir. The following is excerpted from the State of New Mexico, Standards for Interstate and Intrastate Streams (NMWQCC 1995: p. 19):

2113. The Rio Chama from its mouth on the Rio Grande upstream to Abiquiu Reservoir.

A. Designated Uses: irrigation, livestock watering, wildlife habitat, coldwater fishery, warm water fishery, and secondary contact.

B. Standards:

1. In any single sample: pH shall be within the range of 6.6 to 8.8, and temperature shall be less than 31° C (87.8° F). The user-specific numeric standards set forth in Section 3101 are applicable to the designated uses listed above in Section 2113.A.
2. The monthly geometric mean of fecal coliform bacteria shall not exceed 1,000/100 ml; no single sample shall exceed 2,000/100 ml (see Section 1103.B).

2114. Abiquiu Reservoir

A. Designated Uses: irrigation storage, livestock watering, wildlife habitat, primary contact, coldwater fishery, and warm water fishery.

B. Standards:

1. At any sampling site: pH shall be within the range of 6.6 to 8.8 and temperature shall be less than 25° C (77° F). The user-specific numeric standards set forth in Section 3101 are applicable to the designated uses listed above in Section 2114.A.
2. The monthly geometric mean of fecal coliform bacteria shall not exceed 100/100 ml; no single sample shall exceed 200/100 ml (see Section 1103.B).

NOTE: Section 3101. A. indicates that for a coldwater fishery, the dissolved oxygen levels shall not be less than 6.0 mg/l, temperature shall not exceed 20°C (68°F).

The water within the Jemez Canyon Reservoir sediment pool is slightly alkaline with a surface pH of around 7.7 and dissolved oxygen at the surface is greater than 6 mg/l. Turbidity of the pool is high during periods of high inflow rates; however, outflow turbidity is much reduced due to settlement of sediment within the pool itself. Outflow is largely clear during periods of low inflow.

The New Mexico Water Quality Control Commission (NMWQCC 1995) describes the designated uses for the ephemeral reaches of the lower Jemez River as irrigation, limited warmwater fishery, livestock watering, and secondary recreational contact. Designated uses of the Rio Grande from Angostura Diversion downstream to the Alameda Bridge in Albuquerque are the same, with wildlife watering being an additional use.

In the spring of 1999, the Pueblo of Santa Ana, the New Mexico Fisheries Resource Office of the U.S. Fish and Wildlife Service, and the Corps cooperated in a preliminary study of heavy metal concentrations in the reservoir, sediments, and biota at Jemez Canyon Reservoir. Surficial sediment samples showed no contamination of metals, and one water sample was just above the detection limit for mercury. (See additional discussion below regarding biota.)

b. Foreseeable Effects of Planned Action. The planned action should maintain water quality above standards required by the New Mexico Environment Department. Similar actions of this type analyzed in previous environmental assessments, and referenced previously have found few instances of non-attainment of water quality standards. Some potential exist for dissolved oxygen levels to fall below requirements. This will be considered in the final project plans to reduce the risk of low levels. Water quality data is currently being monitored on a regular basis below Abiquiu and Cochiti Dams to ensure levels remain adequately high.

3.06 AIR QUALITY

a. Air Quality Standards. Abiquiu Reservoir is located in the state of New Mexico and U.S. Environmental Protection Agency Air Quality Control Regions 3 and 157, respectively (NMAQ 1994). Existing air quality is good. Although no specific air quality data are known for the immediate vicinity of the project, there are no manufacturing interests or heavy traffic patterns in the area which would degrade air quality or cause significant noise. Some blowing dust is characteristic of the area, especially in spring, when moderately strong winds blow through the Chama Canyon from the west. However, this situation is not unique to Abiquiu Reservoir, but is characteristic of the Southwest in general. Project land, which has been temporarily inundated in the past, generally establishes a vegetative cover of annuals during the next growing season, which (although composed substantially of such nuisance species as cocklebur and dodder) decreases wind erosion and blowing dust. The general area is in conformance with State and Federal Ambient Air Quality Standards. Rio Arriba County has not been designated as

a non-attainment area and is not included in the State of New Mexico's Implementation Plan for the Attainment of the National Ambient Air Quality Standards (NMAAQS 1994).

Sandoval County is within the State of New Mexico's Air Quality Control Region 2 (EPA Region 152) (NMED 1997). The County is in attainment status for National Air Quality Standards for priority pollutants (particulate matter, sulfur oxides, nitrogen dioxide, carbon monoxide, ozone, and lead), meaning that ambient air quality meets or exceeds State and Federal standards. Generally, the only air pollutant of concern in the area is particulate matter (blowing dust during periods of high winds). In the State's Prevention of Significant Deterioration program administered by the New Mexico Environment Department, the region is designated Class II, which allows for moderate development and its associated air emissions. The nearest Mandatory Class I area to Jemez Canyon Reservoir is the Bandelier Wilderness Area, approximately 25 miles to the north.

b. Foreseeable Effects of the Planned Action. Air quality would not be affected by the proposed plan. There are no implied impacts to air quality from any actions associated with storage and/or release of native flows.

3.07 BIOLOGICAL SYSTEMS

a. Abiquiu Reservoir and Rio Chama Downstream

1. Plant Communities. Abiquiu Dam and Reservoir lies within the Great Basin Desert Scrub biotic community as described by Brown and Lowe (1980). Higher elevation terrain surrounding the reservoir is characteristic of the Great Basin Conifer Woodland biotic community. The vegetation on lands in the vicinity of Abiquiu Reservoir varies from bunch grass prairie to pinyon-juniper woodland, depending primarily upon elevation, slope exposure, and soils. The one-seed juniper is prominent on the steeper slopes of dissected terraces or plateaus. The juniper and pinyon pine are both prominent on the shallow, sandy soils of the Santa Fe formation outcroppings and the foothills of Cerro Pedernal. Ground cover in these areas is sparse, probably due to soil and moisture relationships. Considerable areas of woodland have been cleared in the general area during past years to improve grazing.

Grasslands on the project occur typically on flat to gently sloping plains with fine sand loam surface soils and clay loam cattle forage production dominated by galleta, blue grama,
and bottlebrush-squirrel tail. Broom snakeweed and other forbs and shrubs are also present. Range lands within the boundaries of the project, which are accessible to cattle, are generally overgrazed.

The canyon walls and slopes downstream of the embankment are sparsely vegetated with scrub one-seed juniper and pinyon pine, snakeweed, four-wing saltbush, locoweed, wolfberry, rabbit bush, cholla, Mormon tea, and mixed grasses such as Indian rice grass, galleta, threeawn, dropseeds, and sideoats and blue grama. The Corps and USFWS have planted several cottonwoods on this right downstream terrace. This terrace serves as a parking and picnic area.

2. Animal Communities. The overall reservoir area and adjacent lands are of generally moderate value, at best, as wildlife habitat. Upland areas have been heavily grazed, and habitat at lower elevations has been affected by flooding and sedimentation. Wildlife, which now utilize the area in modest numbers, include mule deer, cottontail rabbit, various small mammals, coyote, eastern fence lizard, plateau whiptail lizard, western terrestrial garter snake, mourning dove, nighthawk, rock wren, golden eagle, sharp-shinned hawk, red-tailed hawk, merlin, and swallows.

Most of the rocky slopes and gravelly banks on the project are too unstable to harbor much wildlife. Cliff swallows and white-throated swifts nest on the higher rock faces, along with canyon and rock wrens. Turkey vultures, red tailed hawks and ravens nest in the ledges of the high rock faces below the dam. Woodrats use these high cliffs, as well as the pinyon-juniper areas. Rock squirrels, least chipmunks, and rock wrens use some of the more stable gravelly slopes. The pinyon-juniper areas on project lands support mice, brown towhees, house finches, rufous crowned sparrows, and western flycatchers. Great horned owls, American kestrels, prairie falcons, meadowlarks, and horned larks are also found in the vicinity. Bobcat, and other large mammals occur infrequently in the project area due to disturbance by man. Faunal use of the area that would be disturbed by the project is extremely limited by a combination of human and mechanical disturbances and the direct absence of suitable habitat.

Waterfowl utilizing the reservoir and downstream reache include mallards, common mergansers, Canada geese, common goldeneyes, common loons, hooded mergansers, Western grebes, American wigeon, and redheads. The project is not on a major migration route and has no significant feeding areas, so the reservoir does not attract large numbers of shorebirds and waterfowl.

3. Fisheries. Abiquiu Reservoir is known to support naturally reproducing and stocked populations of rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*), bluegill (*Lepomis macrochirus*), white crappie (*Pomoxis annularis*), largemouth bass (*Micropterus salmoides*) and smallmouth bass (*Micropterus dolomieu*), channel catfish (*Ictalurus punctatus*), longnose dace (*Rhinichthys cataractae*), Rio Grande chub (*Gila pandora*), river carpsucker (*Carpiodes carpio*), fathead minnow (*Pimephales promelas*), flathead chub (*Platygobio gracilis*), Rio Grande Mountain sucker (*Catostomus plebeius*) and white sucker (*Catostomus commersoni*). The New Mexico Department of Game and Fish (NMDGF) currently manages Abiquiu Reservoir as a "cool water" fishery (in between a warm water and cold water lake), emphasizing warm water fish over cold water fish. The NMDGF has also introduced walleye (*Stizostedion vitreum*), yellow perch (*Perca flavescens*), Kamloops rainbow trout, and lake trout (*Salvelinus namaycush*). The relatively recent increase in water storage combined with management of the fishery has resulted in a pronounced improvement. The fishing is currently very good and is improving. Crappie and smallmouth bass are the most frequently caught species.

The presence of Abiquiu Dam and the recent long-term storage of about 200,000ac-ftof water have combined to support a viable cold water fishery downstream of the dam. The release of colder water from the bottom of the reservoir and a reduction of sediment in the water has enhanced physical habitat parameters that favor nonnative trout. The NMDGF has historically managed the fishery in this reach as a "put and take" fishery for brown trout and rainbow trout. However, recent studies by the NMDGF, USFWS, and the Corps have demonstrated a reproducing and self-sustaining brown trout population (Hanson 1992). The quality of the fishery is characterized as fair. The seven-mile reach of the Rio Chama below Abiquiu Dam to the bridge at Abiquiu was classified as "Special Trout Waters" by the NMDGF on April 1, 1991. This limits the number of trout caught to two.

Releases from Abiquiu Dam have appeared to limit sport fishery management and the preservation of native ichthyofauna in the Rio Chama below the dam. Until recently, release rates were sufficiently abrupt to reduce fish survival, especially among young-of-the-year. Also, sudden water temperature decreases, caused by increased discharges of cold hypolimnion water during low-flow periods, could subject fish to temperature induced cold shock, which may impair their ability to feed and avoid predation (Baxter 1977; Hubbs 1972). Sudden decreases in discharges can result in fish being stranded in shallow depressions along the shoreline and eggs incubating in shallow gravel beds being desiccated. To avoid or minimize these adverse effects and maximize the full potential that the project has created, the Corps has modified its gate change procedure to a more gradual discharge change. Gradual changes in discharge will enable aquatic biota to more readily adapt to discharge and temperature changes.

The Corps, in cooperation with the USFWS, funded a two-year study to determine life history and instream flow requirements of fishes on the Rio Chama below Abiquiu Dam (Hanson 1992). A total of 10 fish species were collected during the study. Five native species were collected: Rio Grande chub, Flathead chub, Rio Grande sucker, longnose dace, and fathead minnow. Five introduced species were also collected: brown trout, rainbow trout, white sucker, common carp (*Cyprinus carpio*) and green sunfish (*Lepomis cyanellus).* Study sites were limited to within the first 3 miles downstream of the dam. The management recommendations from this study were:

1) a stable flow from Abiquiu Dam from 1 November to 21 March to maintain brown trout reproduction/ recruitment,
2) a minimum flow of 70 cfs be provided year-round from Abiquiu Dam,
3) a flow of 200 cfs be provided year-round from Abiquiu Dam to maximize brown trout habitat.
4) additional studies of other fish and aquatic organisms be conducted so that instream flows can be identified to benefit the entire ecosystem.

A previous study, also funded by the Corps, considered other fish species in an IFIM analysis, but was still limited to study sites very near the dam (Turner 1982). This study recommended that during normal water years, a minimum of 100 cfs is desirable for the October to March time period. In low water years minimum stream flows could be reduced by 50% (Turner 1982), indicating 50 cfs should be sufficient minimum flow in some years. Appendix C, details historical flow data at the below Abiquiu Dam and Chamita gage sites in low water years between 1971 and 1999, where releases from Abiquiu Dam approximated 50 cfs during the winter months of November through April. This minimum level of flow occurred for an extended duration during the winter months

nine years out of the twenty-nine year period of record. Flows at the Chamita gage averaged 90 cfs during these same periods or 1.5 to 2 times the flows recorded below Abiquiu Dam.

b. Jemez Canyon Reservoir and Jemez River Downstream

1. Plant Communities Jemez Canyon Reservoir is within the Plains-Mesa Sand Scrub biotic community as defined by Dick-Peddie (1993), and vegetation typical of this community dominates the entire area south of the reservoir. The following grasses and forbs occur in sparse to moderately dense stands throughout the area: black grama, New Mexico feathergrass, western wheatgrass, galleta, sand dropseed, and ring muhly. Shrubs commonly found throughout the area include four-wing saltbush, sand sagebrush, rabbitbrush, bush penstemon, and, occasionally, one-seed juniper. Unconsolidated sand dunes with sparse pioneer vegetation occur in a portion of this community. At slightly higher elevations, and often interspersed with the sand scrub community, are pinyon pine / one-seed juniper woodlands.

Riparian and wetland vegetation occurs at the reservoir delta and along the Jemez River below the dam. In the delta area, large mixed stands of Rio Grande cottonwood, Gooding's willow, and coyote willow occur, intermixed with non-native Russian olive and salt cedar. Approximately 230 acres within the 2-mile-long delta reach consists of fairly dense tree- or shrub-dominated stands, and another 75 acres consists of sparse salt cedar. Along the reservoir shoreline and the river below the dam, woody vegetation is more sparsely, linearly distributed. Alkali sacaton and saltgrass are common grass species in these riparian communities

2. Animal Communities. Sand scrub/grassland vegetation has a naturally low carrying capacity for wildlife. Although similarly limited, the scree slopes and steep sides of the mesas to the east and north of the reservoir provide escape cover and protection to wildlife the area. Common wildlife species likely to utilize upland areas around the reservoir include Scaled and Gambel's Quail, Mourning Dove, coyote, badger, cottontail rabbit, jackrabbit, ground squirrel, various songbirds, hawks and, occasionally, mule deer and elk. Riparian habitat is used at least sporadically by virtually all of these species.

The water stored at the reservoir provides habitat to resident and migrating waterfowl such as Canada Goose, Mallard, Northern Pintail, Blue-winged and Green-winged Teal, Northern Shoveler, and American Coot. Sandhill Cranes regularly roost at the reservoir during winter. Waterbirds likely occurring in the area include Great Blue Heron, Spotted Sandpiper, Killdeer, and, during migration, American Avocet, Short-tailed Dowitcher, and Lesser Yellowlegs. Northern Harrier and Osprey have occasionally been observed in the reservoir area. Several nests of Double-crested Comorant occupy inundated, dead trees at the western end of the reservoir.

3. Fisheries. No comprehensive fish surveys have been conducted at Jemez Canyon Reservoir. Fish species known to be present include largemouth bass, white bass, channel catfish, common carp, sunfish, crappie, white sucker, gizzard shad, and small numbers of brown and rainbow trout. Prior to the creation of the current sediment pool, the fish community was comprised primarily of native species (along with white sucker) adapted to the ephemeral condition of the lower Jemez River.

In the spring of 1999, the Pueblo of Santa Ana, the New Mexico Fisheries Resource Office of the U.S. Fish and Wildlife Service, and the Corps cooperated in a preliminary study of heavy metal concentrations in the reservoir, sediments, and biota at Jemez Canyon Reservoir. Tissue samples of largemouth bass and channel catfish indicated some bioaccumulation of mercury. Mercury concentrations in several samples were greater than 0.5 parts per million (ppm) wet weight, indicating a low level of risk for consumption. Preliminary comparison to the U.S. Environmental Protection Agency (1977) "reference doses" suggest that there could be a risk to young children and pregnant women consuming fish for as few as 14 days per year.

c. Foreseeable Effects of the Planned Action. The planned action should not modify the quality of terrestrial habitat on the Rio Chama and Rio Grande downstream of Abiquiu Dam to a significant degree. Effects on the Jemez River however may be more pronounced especially during delivery of higher flows to pass sediment through habitat restoration projects, but should be limited to the immediate timeframe and channel area for delivery of spike flows.

Storage of supplemental flows in Abiquiu and Jemez Canyon Reservoirs will be structured to occur within existing operational constraints for pool levels that have occurred historically. No additional storage will occur above the maximum allowable flood control pool as a result of this action. The result will be an overall net gain in

total volume of water stored in the reservoirs over the spring and summer season. Corresponding benefits to reservoir biological systems should be accrued during this period. Due to this additional storage, a consequent net gain should be realized in sediment retention in the reservoir pools and a net loss in downstream sediment delivery. This will be especially evident in Jemez Canyon Reservoir since the entire sediment pool was scheduled to be evacuated in 2001 as previously discussed (USACE 2000b), effectively resulting in all sediment being passed downstream to the Rio Grande. Sediment load performs an important function in maintenance of riverine functions, habitat maintenance, and energy dynamics throughout the Rio Grande system. Reduction of this sediment load has been determined to be a causative factor in channel and habitat degradation in many reaches of the Rio Grande.

Delivery of supplemental flows will not increase discharge to a level that significant impacts will occur to biological systems throughout the assessment area. Delivery of spike flows on the Jemez River will however disrupt native aquatic biota due to the greatly increased (up to 2000 cfs) discharge and extreme velocity associated with the delivery. This spike flow is designed however to "mimic" historical higher discharge events that have been repressed on this section of the Jemez River downstream of Jemez Canyon Dam, and are not unlike conditions that native fauna have been repeatedly subjected to and recovered from historically.

The effect of reduction in peak flows due to supplemental water storage throughout the area covered in this environmental assessment, is however more difficult to assess. Peak flows occur in the Rio Grande system in similar magnitude, both as the result of seasonal spring snow melt runoff (usually of longer duration), and high intensity summer and fall "monsoon" precipitation (shorter duration peaks). Flows that occur at "bank full" level at an average frequency of occurrence of 1.5 to 2 years are termed "maintenance flows" and perform important functions to readjust channel configurations as disturbances occur, as well as creating variability in aquatic habitat. If the frequency of occurrence of these maintenance flows is affected, there could be correspondingly negative impacts on the riverine system. Peak flows perform other functions in the Rio Grande system including: (1.) seasonal recharge of important wetland and backwater areas, (2.) transportation' distribution, and deposition of riparian plant reproductive materials (including cottonwood and willow seed), (3.) nutrient and organic material replacement and redistribution, (4.) stimulation of native aquatic species' spawning, egg distribution, rearing, and seasonal creation of rearing habitats.

Reduction of flows in the Rio Chama from the beginning of commencement in storage in Abiquiu Reservoir through the end of June will result in a planned average discharge of from 150 to 200 cfs throughout that period (Figure 6). This will effectively eliminate the spring snow-melt run-off peak on the Rio Chama below Abiquiu Dam. This could impact spawning activities of native species. In addition, the average discharge of 150-200 cfs proposed during that period, is well below the average range of discharge (500-1200 cfs) that on the average normally occurs as part of irrigation water deliveries. Effects of these reduced flow levels are more difficult to ascertain.

Changes in the natural cycle of occurrence of the frequency and magnitude of any of these peaks can have an equivalent impact. Peak flows will continue to occur subject to climatic fluctuations, water demands, and management actions. In reality however, the entire middle Rio Grande system currently functions in a state of disequilibrium due to the impacts of dams, diversions, levees, and current water management. Substantially more data remains to be obtained and analyzed before all the intricacies of riverine systems can be understood well enough to confidently predict the results of modest and incremental changes to flow peaks. Available data suggests that supplemental storage and downstream peak reduction, if conducted within reasonable constraints and subject to guidelines that seek to meet requirements of downstream riverine systems and biota, can be accomplished with minimal negative impacts.

3.08 ENDANGERED, THREATENED AND SENSITIVE SPECIES

Included in this section are those species potentially found in the (1). Abiquiu Dam and Reservoir area and the Rio Chama downstream to the Rio Grande confluence; (2.) Jemez Canyon Reservoir area, and Jemez River downstream to the Rio Grande confluence; and (3.) Rio Grande from the Rio Chama confluence to Elephant Butte Reservoir, and that are presently listed as endangered or threatened at the Federal level, USFWS species of concern, and are presently listed at the State level. Requests for lists of protected species were previously made to the USFWS and the state agencies responsible for protecting state threatened and endangered species (USACE 1996, USACE 1999, USACE 2000a, USACE 2000b, USBR 2001). The following species were considered based on the agencies' responses and additional research from the BISON-M database (NMDGF, updated in 2000).

a. Federally Endangered Species

1. Southwestern Willow Flycatcher (*Empidonax trailii extimus*). The southwestern willow flycatcher was recently listed as federally endangered and is also state threatened. The bird is a small neotropical migrant, that occurs in riparian areas of the southwestern United States during the late spring to early summer breeding period. The species is found in riparian areas with dense stands of understory willows (*Salix* sp.), arrowweed (*Pluchea* sp.), baccharis (*Baccharis* sp.), salt cedar (*Tamarix* sp.), and Russian olive trees (*Eleagnus angustifolia*) usually under an overstory of scattered taller shrubs or cottonwoods (*Populus* sp.). The subspecies nests in shrub thickets between 13 and 23 feet tall with a high canopy closure and high density foliage within 13 feet of the ground. The shrub thickets are usually homogenous, even-aged, dense and near standing or slow-moving surface water. The loss of these riparian habitats from throughout the Southwestern U.S. has been cited as a primary reason for the species decline and formal protection. According to Hubbard (1987), the southwestern subspecies of willow flycatchers occurred in New Mexico throughout the Rio Grande Valley, the San Juan and Sangre de Cristo Mountains, and the upper Rio Chama. The subspecies has been confirmed from surveys in 1993 and 1994 to occur along the Rio Grande within a few miles of the confluence of the Rio Chama. In 1994, the Corps funded extensive surveys to determine the presence of southwestern willow flycatchers, the quantity of potential habitat, and the presence of breeding pairs along the 32 miles of the Rio Chama below Abiquiu Dam (Eagle Ecological Services 1994). The surveys determined that only 10 areas totaling about 30 acres of potentially suitable breeding habitat occurred. Surveys for presence of the birds were conducted following standardized protocols. No southwestern willow flycatchers were positively identified. One *Empidonax* was seen but did not sing and could not be identified to species. However, one migrating individual was positively recorded from near Chili, New Mexico, (about 19 air-miles downstream from Abiquiu Dam along the Rio Chama) in 1994 by a USFWS biologist.

Suitable flycatcher breeding habitat occurs in the delta at the western end of the Jemez Canyon Reservoir. No information exists on the presence of this species in the delta, however protocol surveys will be conducted in May through July, 2001. The nearest known breeding flycatchers occur along the Rio Grande near San Juan Pueblo and Isleta Pueblo, 50 miles upstream and 35 miles downstream, respectively, from the confluence of the Jemez River.

2. Rio Grande Silvery Minnow (*Hybognathus amarus*). The Rio Grande silvery minnow was also recently listed as federally endangered due to a significant reduction in range. The species is state listed as threatened. Once extending throughout much of the Rio Grande mainstem and large tributaries, the species now only exists in the reach of river between Cochiti Dam and Elephant Butte Reservoir (Bestgen and Platania 1991). Approximately 90% of the remaining silvery minnow population is found in the Rio Grande downstream from the San Acacia Diversion Dam. The potential for threateningly low flows, and the need for supplemental flow, in that reach of the Rio Grande during 2000 is, in fact, the reason the proposed action has been instigated.

The species has not been collected on the Rio Chama in recent surveys and is presumed extirpated from any portion of the Rio Grande or Rio Chama drainages upstream of Cochiti Dam (Bestgen and Platania 1988; Hanson 1992; Platania 1996). The nearest occurrence to the Rio Chama is from the Rio Grande below Cochiti Dam (Bestgen and Platania 1991).

The Rio Grande silvery minnow is known to occupy the Rio Grande and the Jemez River downstream from Jemez Canyon Dam. Surveys conducted by the Pueblo of Santa Ana and the New Mexico Fishery Resource Office along the lower Jemez River in May 2000, found 21 adult silvery minnows. A portion of this reach immediately downstream from the dam has flood-prone benches which may provide suitable slackwater refugia for minnows during high discharges. The lower portion of the reach is incised and lacks slackwater areas. Silvery minnows likely are present in the lower Jemez River opportunistically during relatively low-flow periods; higher discharges would move the fish downstream to the Rio Grande. Only a single silvery minnow has been captured during monthly surveys between February and August 2000 in the Rio Grande between Angostura Diversion and the Highway 44 bridge (survey data from the Bureau of Reclamation, the U.S. Fish and Wildlife, and the University of New Mexico). However, as many 22 individuals were encountered during surveys of the reach from the Highway 44 bridge downstream to the Corrales siphon.

The species is a small-bodied cyprinid that travels in schools and lays pelagic eggs during spring runoff. The species continues to be threatened due to habitat degradation that has occurred in the remaining range from water management activities.

3. Interior Least Tern (*Sterna antillarum athalassos*). The Interior Least Tern is a shorebird that occurs in wetland, marsh areas as migrants along the Rio Grande. The species is protected as an endangered species by the state of New Mexico. Interior Least Tern is a colonial-nesting water bird, and critical habitat component is unvegetated sand or gravel substrate for nesting. The only breeding population of Interior Least Tern known to occur in New Mexico is located in Bitter Lake National Wildlife Refuge, in Chavez County, along the Pecos River. The bird over-winters south of the Mexican Pacific coast. The species is known only as a vagrant at Bosque del Apache National Wildlife Refuge.

4. Whooping Crane (*Grus americana*). Whooping Crane is federally listed as endangered. The species is protected by the state as endangered, Group II. The species exists in only three wild populations and five captive populations. The species has been reintroduced to the Middle Rio Grande through the experimental populations at Grays Lake National Wildlife Refuge in Idaho. Researchers there are attempting to cross-foster Whooping Cranes with Sandhill Cranes. If successful, Whooping Cranes could migrate to the Middle Rio Grande of New Mexico for over-wintering. During the winter, Whooping Cranes at the Bosque del Apache National Wildlife Refuge use sand bars in the Rio Grande for night roosting. The whooping crane is not known to occur within the Rio Chama Valley.

b. Federally Threatened Species.

1. Bald Eagle (*Haliaeetus leucocephalus*). The status of bald eagle populations in the lower 48 states was recently down listed from endangered to threatened as a result of increasing numbers and range of the populations. In New Mexico, where the species is protected by the state as threatened, Group II, bald eagles over winter in areas abundant with fish or waterfowl for prey. Only two pairs are known to nest in the state; in Sierra and Colfax Counties. Two of the key winter habitat areas in New Mexico are Cochiti Lake, particularly the upstream delta area, and the Bosque del Apache National Wildlife Refuge. These sites have large numbers of waterfowl from November to March that provide the prey base to support foraging eagles. Other areas providing habitat include Navajo Lake, the Chama Valley (Rio Arriba County), the northeastern lakes (Raton to Las Vegas), the lower Canadian Valley, Sumner Lake, Elephant Butte Lake, Caballo Lake, and the Upper Gila Basin. Winter and migrant populations seem to have increased in New Mexico apparently as the result of reservoir construction and the expansion of fish and waterfowl populations. In New Mexico and adjacent areas optimal habitats center on riparian and lacustrine environments where food and shelter are in the greatest supply for the species. The major food items of bald eagles in New Mexico appear to be waterfowl, fish, and carrion. Mammals such as jackrabbits (*Lepus* spp.) are also taken, especially by dry land eagles. The birds typically night-roost in groups in trees usually in protected sites such as canyons.

Bald eagles at Abiquiu Reservoir are intensively monitored and the importance of this reservoir to wintering bald eagles appears to have increased significantly during recent years. Dodd (1979) reported Abiquiu Reservoir as frozen over during the winter of 1979 and saw no bald eagles there. Bald eagles were only sporadically seen on Abiquiu Reservoir during fixed wing counts until recently (1978 through 1986) (Hubbard 1986a). The increased use of Abiquiu Reservoir by bald eagles has directly coincided with the continual storage of the San Juan-Chama water, starting in 1983. Eight helicopter counts between December 1984 and March 1985 showed continuous use of the lake by bald eagles, with a midwinter population of 9 to 11 eagles (Stahlecker 1986a). The Rio Chama, from its confluence with the Rio Grande to El Vado Dam has been intensively monitored by the Corps from 1986 to1996, both by aerial surveys and ground studies. During the winter of 1985 to 1986, a maximum population of 17 was estimated for the Abiquiu Area (confluence to about the Monastery of Christ in the Desert: Stahlecker 1986b). Separate counts on the Rio Chama below the dam showed use by 1 to 6 eagles. No bald eagle use has been observed in the immediate dam area and on the Rio Chama for about two miles below the dam - except for some high flights over the dam. Highway traffic over the dam, activity associated with project operation and maintenance, and recreational use likely deter bald eagle use of the dam area.

Aerial count data from 1984 through 1987 indicated that high flows (greater than 1,000 cfs) discourage bald eagles use on the Rio Chama below Abiquiu Dam (Stahlecker 1987). In 1988 flows in this section of the river were approximately 50 cfs due to construction activities for the hydropower plant at the dam. These low flows resulted in shallower water which made fish more vulnerable and made the lower Rio Chama especially attractive to bald eagles. Prior to 1988 the highest count of bald eagles there was 7 on 15 February 1985, when flows were 146 cfs. All helicopter counts in 1988 exceeded this previous high. These data suggest that flows below 100 cfs may be beneficial to wintering bald eagles (Stahlecker 1988). Bald eagle use may be inversely proportional to discharge, given some minimum at which prey is no longer present in sufficient numbers to attract bald eagles. Other factors

effecting these results include weather conditions, amount of ice on the river or the reservoir, and the abundance of waterfowl on the river or the reservoir.

A comparison of survey counts for 1988 through 1996 for selected reaches of the Rio Chama is presented in Table 3. The date for the surveys is from only the January flights for each year. Some years have additional flights from February, but data here are limited to January surveys for comparison purposes across years. The mean sightings from 1990 to 1996 is 36. The largest number of bald eagles were sighted during 1994 with a total of 62. The last two years' surveys resulted in exactly the same number of citings: 37.

Table 2. Results of bald eagle flight surveys during January from 1988 to 1996 on the Rio Chama by the U.S. Army Corps of Engineers. Data include sightings for both adult and immature birds.

	DATE								
REACH	1/5/ 1988	1/18/ 1989	1/29/ 1990	1/8/ 1991	1/14/ 1992	1/22/ 1993	1/20/ 1994	1/24/ 1995	1/24/ 1996
Rio Chama -Rio Grande confluence to Abiquiu Dam	9	6	9	8	7	4	6	6	6
Abiquiu Res. - Dam to headwaters (includes Seco and Puerco arms)	4	5	0	2	1	0	3	1	3
Rio Chama - headwaters to the Monastery	3	5	6	6	5	7	10	5	3
Rio Chama - Monastery to El Vado Dam*	--	--	6	25	9	24	43	25	25
TOTALS	**16**	**16**	**21**	**41**	**22**	**35**	**62**	**37**	**37**

* Surveys in 1988 and 1989 did not include the Rio Chama from Monastery to El Vado Dam.

Bald Eagles are known to be present along the Rio Grande and at Jemez Canyon Reservoir during the winter. Both adult and juvenile birds may be present in the area between late November and early March. The Corps conducted aerial surveys for Bald Eagles between 1988 and 1996 during January, the month of highest abundance. During the 8 years of survey, Bald Eagles were present at Jemez Canyon Reservoir during 4 years and the number of birds observed ranged from 0 to 3. The same frequency and maximum number of eagles were observed along the mainstem of the Rio Grande from the confluence of the Jemez River downstream to the Interstate 40 bridge at Albuquerque during the same survey period. The number of Bald Eagles observed along the Rio Grande from the Jemez River confluence north to and including Cochiti Lake was significantly higher (Table 4). While data from these areas are not exactly comparable because of the differing length of river channel or lake shoreline, they do indicate that Bald Eagles are not utilizing Jemez Canyon Reservoir preferentially.

Table 3. Bald Eagle occurrence along the Rio Grande and major reservoirs during aerial surveys in January, 1988 to 1996, conducted by the Corps of Engineers.

Reach or reservoir	Number of years present	Mean (SD)	Min.	Max.
Rio Grande: I-40 Bridge (Albuq.) to Jemez River confluence	4	0.8 (1.0)	0	4
Jemez Canyon Reservoir	4	0.9 (1.1)	0	3
Rio Grande: Jemez River confluence to Cochiti Dam	8	12.6 (6.2)	3	23
Cochiti Lake	6	3.7 (5.8)	0	18

c. Other Species of Concern. Federal Species of Concern have no legal protection under the Endangered Species Act but are included for consideration as species that may need special protection. Additional species of federal or state concern were omitted from consideration because: 1) their preferred habitats are typically associated with upland areas away from the river and 2) they are extremely unlikely to be effected by the scope of this action.

1. White-faced Ibis (*Plegadis chihi*). Category 2. The white-faced ibis is a federal Species of Concern. It occurs occasionally throughout much of the state of New Mexico. It is a shorebird associated with marshes and wetlands bordering open waters and nests in dense shrubs or reeds. The species may occur at or near both reservoirs and in suitable wetland habitats bordering riverine areas, likely during the summer breeding season.

2. Flathead Chub (*Platygobio gracilis*). Flathead chub is a federal Species of Concern. The species occurs in New Mexico in the Rio Grande, Pecos, and Canadian drainages. It is widespread throughout much of west central North America in the lower Mississippi River drainage (Sublette et al. 1990). The species is present, but uncommon
in the Rio Chama downstream of Abiquiu Dam. Platania (1991) collected 36 specimens (4 % of the total catch) during his surveys. Recent studies on the Rio Chama have shown that the species remains present in the reach with increasing abundance downstream from the dam (Platania 1996). The species remains relatively abundant throughout the mainstem Rio Grande. Recent studies also indicate the presence of flathead chub in the Jemez River below Jemez Canyon Dam.

3. New Mexican jumping mouse (*Zapus hudsonius luteus*). The New Mexican jumping mouse is a federal Species of Concern and state threatened, Group 2. The species range is fairly widespread in western North America. It may be limited in the arid southwest from limitations in quality habitat availability. The species is most often associated with riparian or other moist-soiled habitats with dense vegetation.

4. Spotted bat (*Euderma maculatum*). The spotted bat is a federal Species of Concern and state threatened, Group 2. The species is widespread in western North America. It occurs in New Mexico from the Rio Grande Valley westward, through the Jemez, San Mateo and Mogollon Mountains, and has been recorded from Ghost Ranch, north of Abiquiu Reservoir. The species inhabits cliffs over perennial water, but has been found associated with a wide variety of vegetation types.

5. Rio Grande chub (*Gila pandora)* The legal status of the Rio Grande chub as listed by the State of New Mexico is "Species of Concern" within the state (NMDGF, 1994). This species is found in impoundments and pools of small to moderate streams and is frequently associated with aquatic vegetation. Rio Grande chubs occupy perennial mainstream and tributary habitat at higher elevations. The historic distribution of Rio Grande chub was mainly the coolwater reaches of the Rio Grande and Pecos River (and tributaries) in northern New Mexico. The recent study on the Rio Chama (Platania, 2000), has shown that the species remains present in the reach

d. Foreseeable Effects of the Planned Action The following determination of effects for the currently proposed project is pursuant to the requirements of the Endangered Species Act of 1973, as amended (Table 2).

1. Southwestern Willow Flycatcher. The planned storage of excess native flows will occur during periods when background flows are already at a high level, such as during spring snowmelt runoff or high intensity summer precipitation events, on the Rio Chama and the Jemez River. Documented southwestern willow flycatcher breeding areas occur on the mainstem Rio Grande where the magnitude of resultant flow fluctuations will be moderated by continued runoff from upstream. Delivery of supplemental water during low flow periods, once these flows again reach the Rio Grande will be masked by the overall volume of irrigation water deliveries, and will have no discernable significant impact until water arrives at the most downstream reaches (from Isleta Diversion Dam to Elephant Butte Reservoir). The most notable flow fluctuations as a result of storage and supplemental flow delivery occur along the Rio Chama and Jemez River, where the species has not recently been documented. **Therefore, the planned action is not likely to adversely effect the southwestern willow flycatcher**.

2. Rio Grande Silvery Minnow. The Rio Grande silvery minnow (RGSM) no longer occurs within the Rio Chama or the Rio Grande upstream of Cochiti Dam. The RGSM documented recently in the Jemez River are considered to be a small ephemeral population that moves opportunistically in and out of the Rio Grande. Again, the planned storage of excess native flows will occur during periods when background flows are already at a high level, such as during spring snowmelt runoff or high intensity summer precipitation events and the magnitude of resultant flow fluctuations will be moderated within the occupied habitat where RGSM have been documented

Delivery of supplemental water during low flow periods, once these flows again reach the Rio Grande will be masked by the overall volume of irrigation water deliveries, and will have no discernable significant impact until water arrives at the most downstream reaches where all irrigation water has been removed from the system (from Isleta Diversion Dam to Elephant Butte Reservoir). From the Isleta Diversion Dam downstream, the supplemental flows should be sufficient to maintain a 100 cfs discharge below Isleta Diversion Dam, and a 50 cfs discharge below San Acacia Diversion Dam. This volume of flow should be sufficient to maintain continuous flow in the Rio Grande to the Escondida area approximately one mile north of Socorro, New Mexico throughout the year even in abnormally dry years. As previously discussed, approximately 90% of the remaining silvery minnow population

existing in the wild, is found in the Rio Grande downstream from the San Acacia Diversion Dam. The proposed volume of supplemental flow will be insufficient to maintain continuous flow throughout this remaining occupied habitat area, but at least represents a marginal alternative to total loss of flows below San Acacia Diversion, and intermittency up to the Isleta Diversion.

It is understood that a multitude of additional actions will be required to begin reversing the current trend of RGSM decline. Supplemental flows as outlined do not represent the optimal scenario needed to sustain RGSM, but will have a benefit to the species in sustaining overall cover and feeding habitat in a portion of its remaining habitat. Storage and release could be insignificant or possibly beneficial if executed within guidelines structured to maximize benefit to RGSM. Cumulative effects on RGSM are ongoing within the current regime in the Rio Grande system, but within constraints should not be exacerbated by the planned action. Based on this determination , **the planned action is not likely to adversely effect the Rio Grande silvery minnow.**

3. Interior Least Tern, and Whooping Crane. Due to the low probability of occurrence of these species within the impacted area and the absence of any significant adverse habitat modifications, **the planned action will have no effect on interior least tern or whooping crane**.

4. Bald Eagle. The planned action would take place for the period when bald eagles are not known to utilize the impacted area. Storage of supplemental water may be carried over during winter periods in which bald eagles are present feeding and roosting. At Jemez Canyon Reservoir, where the termination of the active pool was expected, the proposed action would have a beneficial effect. The storage levels will be within constraints that would not adversely affect bald eagle presence and use of the reservoirs. Impacts of reduced peak flow levels that effect overall habitat quality, food availability, and riparian health, could over a period of time be negative but are should not be significant enough over the three year period of this proposal to affect eagle use of Jemez Canyon, Cochiti, Abiquiu Reservoirs, or any associated riverine areas. **Therefore, the Corps determines that the planned action is not likely to adversely effect the bald eagle**.

5. Other Species. The planned action is not likely to adversely effect other animal or plant species that are candidates for listing as federally endangered or threatened. In addition, the action is not likely to adversely effect those species listed as endangered or threatened by the State of New Mexico.

3.09 RECREATIONAL RESOURCES

a. Abiquiu Reservoir. The Abiquiu Master Plan for public use and recreational development was recently completed by the Corps (USACE 1995b). Popular recreation activities at Abiquiu Reservoir include boating, fishing, water skiing, swimming, camping, picnicking, and sightseeing. Annual visitation has increased steadily up to over 103,000 visitors in 1994 (USACE 1995b). Increasing visitation is related to the general increase in regional demand for water oriented recreational opportunities and a larger and more permanent body of water, which has expanded the availability and attractiveness of recreational opportunities.

b. Jemez Canyon Reservoir. The public use area at Jemez Canyon Dam is limited to 10 acres atop the outcrop immediately south of the dam. The day-use area consists of 6 picnic shelters, a parking lot with 12 automobile spaces, garbage containers, a vault toilet, 3 water hydrants, a bulletin board. Area lighting is provided by the Public Service Company of New Mexico. Because of the limited facilities, public visitation is low when compared to other attractions in the area. During fiscal year 1999, 19,324 visitor-hours were estimated at Jemez Canyon Dam, compared to 1,132,103 visitor-hours at nearby Cochiti Lake.

c. Recreational Fishery. The two-mile stream reach of public land on the Rio Chama below Abiquiu Dam receives an estimated 1,200 to 1,500 angler days of use annually. From this point to its confluence with the Rio Grande, the Rio Chama receives approximately 2,000 angler days of use annually. Public use in this reach is limited by private land and lack of access in many areas. NMDGF stocks this reach regularly with brown trout and rainbow trout. Abiquiu Reservoir is also a popular public recreational coldwater fishery managed by NMDGF. The recreational fishery at Jemez Canyon Reservoir and the Jemez River downstream is limited to Santa Ana Pueblo Tribal members. The mainstem Rio Grande in the affected area from the Rio Chama confluence to Elephant Butte Reservoir sustains a moderate recreational fishery for a wide variety of species. The tailwater fishery below Cochiti Dam receives the heaviest use of all areas in this reach.

d. Foreseeable Effects of the Planned Action. Ongoing recreational activities at Abiquiu and Jemez Canyon Reservoirs as well as riverine areas upstream and downstream should be minimally affected by the planned action. The storage of native flows and the establishment of a temporary conservation pool would act to maintain recreational resources and use, since previous evacuation of the reservoirs due to downstream water demands, and operations restrictions have resulted in negative impacts on the fisheries and recreational use of the reservoirs for periods of time.

Since storage will only occur during periods when excess water is available in the system, and releases to supplement downstream flows will sustain flows throughout the system where water is delivered, a potential benefit may be accrued to recreational fisheries in the Rio Chama, Jemez River, and Rio Grande. The cumulative impact of ongoing sustained high flow conveyance and intermittent rapid and extreme fluctuations during the March through November period in the Rio Chama is undoubtedly affecting the fishery negatively in contrast to a more natural flow regime. Storage during high flow periods could serve to temper some of those extremes, but also suppress those flows that serve a channel maintenance function, thereby helping to maintain and create aquatic habitat. Delivery of supplemental water will be insignificant in context to the total volume of water being delivered during this period.

Periodically wetting and drying river banks to a higher stage could temporarily accelerate bank erosion and sloughing. These impacts have been incumbent on the Rio Chama and Jemez River, in the ongoing operation of Abiquiu and Jemez Canyon Dams. The proposed temporary high flows from Jemez Canyon Dam would exacerbate the instability of the Jemez River bed below the dam to the confluence with the Rio Grande but serve the function for which they are intended to provide flushing flows for habitat improvement projects, and supplement spawning flows on the mainstem Rio Grande.

3.10 ARCHEOLOGICAL AND CULTURAL RESOURCES

Abiquiu Dam and Reservoir and Rio Chama Downstream

a. Background. The Corps of Engineers has a long history of involvement with New Mexican archaeology. In 1849, Lt. George H. Simpson, Corps of Topographical Engineers, described and made the first sketch plans of many of the largest Anasazi Ruins in Chaco Canyon, New Mexico. In 1850 and 1852, Corps' expeditions traversed the location where, 120 years later, the Albuquerque District of the Corps undertook archaeological survey and excavation in conjunction with the construction of Santa Rosa Dam. In 1874, Lt. George M. Wheeler, Corps of Engineers, led an expedition through the Chama River Valley and recorded prehistoric Indian ruins near the village of Abiquiu. Exactly 100 years later the first reports detailing the results of archaeological survey at Abiquiu Reservoir was published (Schaafsma 1974). Cultural resources work within the boundaries of the Abiquiu project continued intermittently during the following 20 years.

Of the 350 sites recorded during various surveys, 291 were determined eligible for the National Register of Historic Places. These sites represent all temporal periods from Paleo-Indian to the early 1900s, (Paleo, Archaic, Basketmaker, Anasazi, Piedra Lumbre, Ute, Jicarilla Apache, Pueblos [in particular, Tewa branch of the Tanoan linguistic family], Spanish Colonial, Mexican, and United States Territorial and Statehood). For more detailed discussion of the early periods refer to the section under Jemez Dam. Lithic scatters are the most commonly occurring site type in the reservoir area due in part to the proximity to obsidian and chert sources in the surrounding mountains and in the gravel terraces adjacent to the Chama River. Lithic scatters vary in size, artifact density, and associated features such as hearths or storage pits. Many date to the Archaic Period and are a very important component of the archaeological record in northern New Mexico. As of 1995, there were over 15,500 recorded sites in Rio Arriba County, and approximately 15 percent of all the recorded Archaic Period sites are located at Abiquiu Reservoir. The reasons for this unusual concentration have not been determined. Several of the Archaic sites were the locations of permanent residences complete with pit houses, and grinding and cutting tools.

Based on extensive obsidian hydration dating it appears that most of the Pueblo-period use of this area was for hunting and gathering rather than permanent residences and agriculture. Although several medium-sized late Pueblo III/early Pueblo IV villages occurred within the project boundaries, they were the exception rather than the rule. This location is towards the upper climatic limits for reliable agricultural production; however, it is ideally situated for temporary camps used on a seasonal basis by Pueblo Indians residing in the lower Chama River valley.

The earliest Spanish expeditions through New Mexico by-passed the Chama Valley, but in 1598 Juan de Onate established the first European settlement near the confluence of the Chama and Rio Grande Rivers. After

several months in a temporary camp on the east bank of the Rio Grande, they moved across the river and settled at the village of Yuque Yunque and called it San Gabriel (near modern day San Juan Pueblo). This, the capital of New Mexico, was relocated to its current location in Santa Fe in 1610 (Jenkins and Schroeder 1974). During the subsequent several centuries the European settlement in the Abiquiu area fluctuated with the policies and economies of the Spanish and later the Mexican governments. Both Spanish and Mexican land grants were awarded in this area, and some of their boundaries and ownerships are still in dispute (in 2001). To augment the variable rainfall, one of the first community-wide activities undertaken at newly established Spanish and Mexican settlements was the construction of an *acequia* to carry water to the fields.

In addition to the vagaries of the amount and timing of rainfall and the length of the growing season, the fluctuating relations between the Hispanics and the Indians resulted in abandonment of the small European communities for years at a time. In addition to the Pueblo Indians, the more nomadic groups such as the Apache, Ute, Navajo, and on one occasion the Comanche, periodically occupied the area and the interactions between all of these groups varied from friendly to hostile. Metal arrowheads and spear points and glass trade beads recovered from sites in the project reflect these transient populations.

While the first non-local Indian settlers of the upper Chama Valley near the project location were families who returned with de Vargas in 1692 to 1695 during his request following the Pueblo Revolt in 1680, the earliest documented Hispanic homestead in the Reservoir area dates to the 1730s. In addition to several Spanish and Mexican wood, adobe, or *jacal* homesteads, a mill powered by water from a small *acequia* occurred on the Abiquiu project. The mill was constructed between 1806 and the mid-1830s by Pedro Ignacio Gallego (Carrillo 1992).

b. Historic Properties. The project area has been formerly disturbed and previous cultural resource surveys have not revealed the presence of any archeological or historical properties eligible for inclusion in the National Register of Historic Places.

c. Foreseeable Effects of the Planned Action. No properties entered in, or determined eligible for inclusion in, the National Register of Historic Places would be affected. The State Historic Preservation Officer concurred in previously referenced EAs with a determination that the undertakings would not affect cultural resources since all activities would be confined to previously disturbed land areas. Over the years, Congressionally mandated changes in the operation of the dam from exclusively flood control to a permanent pool and flood control, and subsequent increases in the volume of water storage, resulted in increases in the pool's surface elevation. The effects of these water increases on the archaeological sites have been mitigated for those sites located below 6,240 feet above sea level. As a result of the proposed action and even with the addition of an estimated 50,000 acre-feet of spring run off, the resulting surface elevation will be approximately 6216.0 feet above sea level. This elevation is well below the 6,240 feet; therefore, the proposed action will have no effect on the cultural resources of Abiquiu Reservoir.

Jemez Canyon Reservoir and Jemez River Downstream

a. Background. The Jemez Canyon Dam is within the archaeological area defined by Wendorf and Reed as the Northern Rio Grande Region (Rodgers, 1979). The approximately 12,000 years of cultural interaction in this area can be subdivided into three broadly defined periods based on constellations of artifacts recovered archaeologically. Given the ecological nature of the surrounding region, the remains associated with rather short-term resource exploitation by hunter-gatherers represent the first 10,000 years. The earliest sites date between approximately 10,000 B.C. and 5,500 B.C. and represent the Paleo-Indian big-game hunters. Clovis Points (10,000 B.C. to 9,000 B.C.), generally associated with mammoth, and Folsom Points (9,000 B.C. to 8,000 B.C.) associated with the extinct *Bison antiquus* are found in isolation and at small sites. Other extinct game animals include camel and horse. Most Paleo-Indian sites in the greater Albuquerque area have been recorded during survey, although some excavation occurred prior to housing construction at Rio Rancho. The range of site types identified includes tool manufacturing, resource processing related to hunting, and base camps occupied for longer periods of time. Many of these sites are on high ground with unobstructed views (Rodgers 1979). Other Paleo-Indian Point types that have been recognized in the Southwest and New Mexico include Hell Gap, Midland, Plainview, Milnesand, Meserve, and Scottsbluff. Diagnostic Paleo-Indian spear points are lanceolate-shaped with flutes removed from both sides; other tools that have been recovered include scrapers, knives, perforators, and informally utilized flakes. While plant gathering and processing occurred, the artifacts associated with these activities have not been generally recognized.

The Archaic Period extends from approximately 5,500 B.C. to A.D. 400 and represents a continuation of the hunting-gathering adaptation. By this time the population of animals is similar to those found today and this represents the primary difference from the preceding Paleo-Indian Period. Both large and small animals were hunted and trapped. Based on the increasing presence of manos and metates, it is clear that the processing of plants becomes more important. Towards the end of the Archaic, longer-term habitation sites that include shallow pit houses are found in areas of the Southwest including central New Mexico. Limited activity Archaic Period sites without diagnostic projectile points, especially those exposed on the surface, can be difficult to identify and are recorded as temporally unknown sites. The undiagnostic lithic scatter is the most commonly recorded site in the Laboratory of Anthropology data base.

Along the Rio Grande within northern and central New Mexico, the Archaic–Period inhabitants are referred to as the Oshara Tradition. This Period is subdivided into six phases based on differing diagnostic projectile points, although two major changes occurred towards the end of the Archaic. Indications of maize appear in the archaeological record by about 2000 B.C.; however, it becomes relatively more common after 1000 B.C. Finally the bow and arrow appears about A.D. 500 and replaces the spear as the primary weapon (Rodgers 1979; Bayer 1994).

The Archaic Period is succeeded by the Anasazi or Pueblo Period. Depending on the location in northern New Mexico, between three and five major phases are recognized and are based on a host of characteristics, including house forms and construction techniques, settlement patterns, pottery types, and other elements of material culture. While hunting and gathering continued, reliance on agricultural products continually increased. Pit house villages with larger communal structures indicate larger social groups living in one location for longer periods of time. Initially small surface living and storage rooms with below ground communal and religious structures supplant and generally replace the pit house villages. As populations increased, these small houses were replaced with large buildings of up to several hundred rooms made of rock and or adobe. Not all of the rooms were necessarily occupied at once.

The Developmental Period dates between A.D. 600 and 1200 and can be subdivided into Early and Late depending on the predominance of pit house or above ground architecture. Early in the period the associated ceramics are similar to those found throughout the Pueblo area; later in time the stylistic attributes, including paint, design, and temper, become more locally diagnostic. The Coalition Period, A.D. 1200 to 1325 marks a more intensive use of the Pajarito Plateau; a change from mineral- to carbon-paint pottery; and as suggested by the number, size, and distribution of larger permanent habitation and seasonally-specific special-use sites, a marked increase in the population. The Classic Period, A.D. 1325 to 1600, spans the time of the widest settlement distribution, the largest sites, and the earliest Spanish contact beginning with the Coronado Expedition in 1540. After several expeditions by others, the first permanent Spanish occupation in New Mexico began in 1598 near the present location of San Juan Pueblo. Glaze-painted pottery is introduced for the first time. Increasingly sever and wide spread droughts and impacts from the European colonizers disrupted the native population. There was a gradual retrenchment into an aggregated settlement pattern (Rodgers 1979; Bayer 1994).

The Historic Period is characterized by rapid change and acculturation between the Indians, Spanish, Mexicans, and Americans. The Period dating from about A.D. 1540 to the present can be divided into seven phases reflecting aspects of social interaction, such as Spanish Exploration, followed by Colonization, the Pueblo Revolt, Spanish and Mexican Colonial, United States Territorial, and Statehood.

Currently, there are four major linguistic groups among the Pueblo Indians of the Southwest: Zuni, Hopi (Uto-Aztecan), Tanoan, and Keres. There are seven major dialects of Keres, including the western groups of Acoma and Laguna; and the eastern groups of Santo Domingo, San Felipe, Cochiti, Zia, and Santa Ana. The latter two dialects are sufficiently close to suggest a separation of less than 600 years. There is general agreement that the recent ancestral homeland of Santa Ana, that is after A.D. 1300, included, among others, locations in the Pajarito-Frijoles River areas, locations adjacent to the Rio Grande, the Galisteo Basin and perhaps Paa-ko. However, there is less agreement concerning their ancestor's location prior to A.D. 1300. Based on a variety of materials recovered archaeologically, including ceramics, many scholars believe that their ancestors originated from the general area around Mesa Verde and the Four Corners of New Mexico, Colorado, Arizona, and Utah. This agrees with the Santa Ana and Keres legends of moving to the south (Akins 1993; and Bayer 1994).

No archaeological work occurred at the time of the 1950 to 1953 Jemez Dam construction; however, two archaeological surveys were conducted in conjunction with later undertakings at the dam. The first, a survey was conducted in 1977. The survey included a 200-foot wide road right-of-way of an entrance road to the dam from

Highway 44, the realignment of the old haul road into the canyon, and a 10-acre overlook recreation area. A total of 10 limited activity sites were discovered. These included one prehistoric ceramic and lithic scatter from the Classic Period; four undiagnostic lithic scatters; one field house with no associated artifacts; two small habitation structures with associated corrals; and two religious sites (Ward 1977).

The second archaeological investigation, a survey of 1,200 acres in the flood pool, occurred in 1979 in conjunction with the establishment of a permanent 2,000 acre-foot sediment pool. A total of 18 archaeological sites and 17 locations of isolated artifacts were recorded. Seven prehistoric sites; six early historic sites, dating after A.D. 1550; and five sites from the recent historic, after A.D. 1700, were recorded. The kinds of sites recorded include petroglyphs, lithic scatters, habitation, agricultural, and ranching.

No excavations were conducted. During the survey, a small number of sherds and lithics were collected in order to accurately determine their typological categories. These artifacts were returned to the Pueblo in 1980.

b. Historic Properties. Traditional cultural properties do occur within and adjacent to flood control space of the Jemez Canyon Dam and Reservoir project. The project area has been formerly disturbed and previous cultural resource surveys have not revealed the presence of any archeological or historical properties eligible for inclusion in the National Register of Historic Places.

c. Foreseeable Effects of the Planned Action. No properties entered in, or determined eligible for inclusion in, the National Register of Historic Places would be affected. The State Historic Preservation Officer concurred in previously referenced EAs with a determination that the undertakings would not affect cultural resources since all activities would be confined to previously flooded or disturbed land areas.

3.11 SOCIOECONOMIC ASPECTS OF THE IMPACT AREA

a. Socioeconomics. The socioeconomic study area for Abiquiu Dam and Reservoir, and the Rio Chama, which encompasses the eastern portion of Rio Arriba County, had a 1992 population of 34,891 persons; up 17.4% from the 24,228 in 1980 (Boatmen's Sunwest 1994). The population is predominantly of Hispanic origin. Family size and unemployment are high, while personal income and the general status of housing are low. In 1993, the county's unemployment rate was 12.8%, compared with 7.5% for the state of New Mexico. Employment by broad industry sector shows that government, services, and trade comprised about 80 percent of the wage and salary employment in 1979. Agriculture comprised only about three percent.

Inhabitants of the Abiquiu general area reside in small, rural villages, are primarily agrarian, and predominantly Hispanic. The unemployment rate in the County is consistently among New Mexico's highest. Low density cattle grazing is the predominant use of lands
surrounding the reservoir. Farming is the predominant use of the floodplain below the dam.

The Pueblo of Santa Ana Reservation covers approximately 79,000 acres spanning the Rio Grande and lower Jemez River. The majority of the population of approximately 650 resides near Los Ranchitos along the east side of the Rio Grande. The primarily ceremonial old pueblo mentioned previously in this document is located at the west end of Jemez Canyon Reservoir.

Principal employment sectors include agriculture and service. Over the past 25 years, the Pueblo of Santa Ana has developed a successful agricultural enterprise centered on the production and processing of organic blue corn products. Other natural resource enterprises include sand and gravel mining and a native plant nursery. Extensive recreational and entertainment attractions include the Santa Ana Star Casino, the Prairie Star Restaurant, a 27-hole golf course, and a 22-field soccer complex. The Tamaya Hyatt resort is planned to open in December 2000.

b. Foreseeable Effects of the Planned Action. The economy and social structure and activities of the Rio Chama, Española, and middle Rio Grande valleys would gain a higher degree of insurance that flooding would not adversely affect these features. The added ability to resolve any malfunction of the service gates at Abiquiu Dam without adverse consequences to downstream communities would be a significant beneficial effect to social well-being, health, and the economy.

Executive Order 12898 (Environmental Justice) requires "to the greatest extent practicable and permitted by law, and consistent with the principles set forth in the report on the National Performance Review, each Federal

agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations..." The work has been reviewed for compliance with this order and it has been determined that the proposed action would not adversely affect the health or environment of minority populations."

3.12 NATIONAL WILD AND SCENIC RIVERS SYSTEM

Public Law 100-633 dated November 7, 1988, amended the Wild and Scenic Rivers Act to designate segments of the Rio Chama as a component of the National Wild and Scenic Rivers System. These segments and associated management responsibilities are as follows:

a. Segment 1 - Wild and Scenic Section. From El Vado Dam launch site downstream approximately 24.6 miles to elevation 6353 as a component of the Wild and Scenic Rivers System to be administered by the U.S. Forest Service and the Bureau of Land Management. The segment between the launch site and the beginning of Forest Service Road 151, at the northern property boundary of the Christ in the Desert Monastery, is classified as a Wild River. The segment from that point downstream to elevation 6353 feet is classified as a Scenic River.

b. Segment 2 - Study Section. From elevation 6353 downstream to elevation 6283.5, a distance of approximately 4.0 miles, receives the same protection afforded to study rivers listed in Section 5 (a) of the Wild and Scenic Rivers Act.

c. Segment 3 - Joint Management Section. From elevation 6283.5 downstream approximately 1.8 miles to elevation 6235 as a joint management area by the Corps, Forest Service, and Bureau of Land Management pursuant to:

X The preferred alternatives for the proposed Santa Fe National Forest Plan (January 1986); The Interim Rio Chama River Management Plan, as amended by the Rio Chama Management Plan (dated November 1990) and the previously authorized operation of Abiquiu Dam;

X The operation of Abiquiu Dam by the Corps.

d. Dam Operations. Public Law 100-633 also states "that nothing in the Act or the Wild and Scenic River Act shall interfere with the Secretary of the Army's operation and management of Abiquiu Dam for purposes authorized by Section 5 of Public Law 97-140 or otherwise authorized prior to December 31, 1988."

e. Foreseeable Effects of the Planned Action. The primary effect that repair of the emergency gates would have on the three designated segments of the Wild and Scenic Rivers System on the Rio Chama would be to prevent the unnecessary inundation of Segment 2 (Study Section) should the service gates fail. Inundation of Section 2 could possibly result in a significant change in riverine and riparian characteristics.

3.13 RESERVOIR OPERATIONS AND DAM MAINTENANCE

a. Flood Control. The planned action would not decrease the flood control function of Abiquiu Dam and Jemez Canyon Dam. The flood potential of the Rio Chama and Jemez River results from both snowmelt runoff and rainfall events. However, the majority of the required flood control storage is for snowmelt runoff. This being the case, it is possible to make dual use of a portion of the snowmelt flood storage. This is possible since snowmelt runoff is predictable, and reasonably accurate forecasts of snowmelt runoff can be made, which would allow for evacuation of the conservation water occupying a portion of the flood pool. Evacuation of the conservation water stored under this settlement agreement would be required when a snowmelt or rainfall runoff indicates a need for the flood space. The evacuated conservation storage would be recaptured with the incoming flows.

b. Reservoir Storage. The planned action would protect the San Juan-Chama water, which is currently stored in Abiquiu and Jemez Canyon Reservoir. No part of this water will be considered part of the proposed action. With the drier than normal weather, the Middle Rio Grande Conservancy District (MRGCD) is expected to store a majority of the natural inflow into El Vado from April 1 to June 1. The expected release from El Vado during this time frame would be approximately 100 cfs. The outflow from Abiquiu Dam will be limited to 150 cfs from April 15 until there is a need to start passing inflow to meet Middle Grande Conservancy District (MRGCD) irrigation

demand. The Corps will store all natural coming into Abiquiu Reservoir above 150 cfs starting on April 13. The forecasted amount of storage that could be captured before the project needs to be operated to meet irrigation demand is approximately 50,000 ac-ft.

Jemez Canyon Reservoir will be operated to store natural starting on April 13. The outflow from Jemez Dam will be limited to 20 cfs from April 13 until the pool reaches the top of the sediment pool (24, 425 acre-feet) or there is a need to start passing inflow to meet Middle Grande Conservancy District (MRGCD) irrigation demand. At Jemez Canyon Reservoir 14,000 acre-feet of water would be for providing supplemental water for the silvery minnow and 6,000 acre-feet would be used to provide a spike release of approximately 5,000 cfs through the Middle Valley. Jemez Canyon Dam would be operated to release 1,500 to 2, 000 cfs when the projected maximum release from Cochiti Dam is being made. The projected flow for this operation would be a combined release of approximately 5,200 cfs at Albuquerque. This spike release would offset the Corps storage of native water at Abiquiu Reservoir.

c. Hydropower Generation. This proposed action is consistent with the Memorandum of Understanding with the County of Los Alamos and applicable licenses since the power plant is run of river. The county of Los Alamos does not normally generate power unless the release is less then 150 cfs. During the time period mentioned above that Abiquiu is storing the county of Los Alamos would be generating power. The County of Los Alamos will be impacted by the amount of power it can generate.

d. Interstate water deliveries The planned action will have minimal effect on overall water management of the Rio Grande, relative to interstate water delivery requirements of the Compact.

e. Foreseeable effects of the planned action At Abiquiu or Jemez Canyon Reservoirs there are no foreseeable effects that impact flood or sediment control. Implementing the proposed action would result in some changes in reservoir levels and releases, which would be a benefit to recreation and slivery minnow respectively. There would no impacts to the MRGCD or Rio Chama Acequia's since their irrigation demand is being met. Hydropower generation at Abiquiu Reservoir would be impacted by the smaller release rates and the total amount of water released during the year. Impact at Jemez Canyon Reservoir would be the delay in the mitigation actions taking place as result of the drawn down from the previous year. This is not a negative impact since it gives the Corps and the Pueblo Santa Anna more time to work on mitigation plan.

4.0. CONCLUSION

The storage of supplemental water and delivery downstream as outlined in this environmental assessment represents only a small action in a much larger scenario of actions needed to reverse the current decline in habitat and biota, as well as meet socioeconomic demands. Transfer and storage of accrued credit water to upstream reservoirs from Elephant Butte Reservoir provides for much more effective utilization of native flows to the benefit of the natural system and delivery efficiency. Supplemental flows as outlined will have a modest benefit to the biota in sustaining overall aquatic habitat, and riparian zone moisture levels. Reductions in peak flows during storage will have an implied negative impact but could be insignificant or possibly beneficial if executed within guidelines structured to maximize benefits to the riverine system and biota. The action would be implemented to insure the flood control function of all projects, insure normal water deliveries as part of an operational component of water management in the basin, protect the storage of San-Juan Chama water, and insure that fish and wildlife resources and associated recreational opportunities in the lake and downstream river areas are preserved. The action can be accomplished within the guidelines previously discussed, without major adverse effects to ecological systems, cultural resources, or socioeconomic features.

5.0. COORDINATION

Data presented in this EA was reviewed by the U. S Fish and Wildlife Service and New Mexico Dept. of Game and Fish for concurrence with the determinations of effects on species listed as federal or state threatened or endangered, or other sensitive species occurring in the project area (see attached letter, Appendix B). All Native American nations in the impact area have been contacted to assure minimal conflicts will occur related to scheduled activities. Local acequia associations have been contacted and flow changes will be closely coordinated with them.

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APPENDIX A

LAWS OF THE 86th CONGRESS--SECOND SESSION, July 14, 1960

EXCERPTS FROM PUBLIC LAW 86-645; 74 STAT. 480
[H. R. 7634]

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That:

TITLE II--FLOOD CONTROL

Sec. 203. The following works of improvement ... are hereby adopted and authorized to be prosecuted under the direction of the Secretary of the Army and the supervision of the Chief of Engineers...

RIO GRANDE BASIN

The project for improvement of the Rio Grande Basin is hereby authorized substantially as recommended by the Chief of Engineers in Senate Document Numbered 94, Eighty-sixth Congress, at an estimated cost of $58,300,000.

The approval granted above shall be subject to the following conditions and limitations:

Cochiti Reservoir, Galisteo Reservoir, and all other reservoirs constructed by the Corps of Engineers as a part of the Middle Rio Grande project will be operated solely for flood control and sediment control, as described below:

(a) the outflow from Cochiti Lake during each spring flood and thereafter will be at the maximum rate of flow that can be carried at the time in the channel of Rio Grande through the middle valley without causing flooding of areas protected by levees or unreasonable damage to channel protective works: *Provided*, That whenever during the months of July, August, September, and October, there is more than two hundred twelve thousand acre-feet of storage available for regulation of summer floods and the inflow to Cochiti Reservoir (exclusive of that portion of the inflow derived from upstream flood-control storage) is less than one thousand five hundred cubic feet per second, no water will be withdrawn from storage in Cochiti Reservoir and the inflow derived from upstream flood-control storage will be retained in Cochiti Lake.

(b) Releases of water from Galisteo Reservoir and Jemez Canyon Reservoir during the months of July, August, September, and October, will be limited to the amounts necessary to provide adequate capacity for control of subsequent summer floods; and such releases when made in these months, or thereafter, will be at the maximum rate practicable under the conditions at the time.

(c) Subject to the foregoing, the storage of water in and the release of water from all reservoirs constructed by the Corps of Engineers as part of the Middle Rio Grande project will be done as the interests of flood and sediment control may dictate: *Provided*, That the Corps of Engineers will endeavor to avoid encroachment on the upper two hundred and twelve thousand acre-feet of capacity in Cochiti Reservoir, and all reservoirs will be evacuated completely on or before March 31 of each year: *And provided further*, That when estimates of anticipated streamflow made by appropriate agencies of the Federal Government indicate that the operation of reservoirs constructed as a part of the Middle Rio Grande project may affect the benefits accruing to New Mexico or Colorado, under the provisions of the eighth unnumbered paragraph of article VI of the Rio Grande compact, releases from such reservoirs shall be regulated to produce a flow of ten thousand cubic feet per second at Albuquerque, or such greater or lesser rate as may be determined by the Chief of Engineers at the time to be the maximum safe flow, whenever such operation shall be requested by the Rio Grande compact commissioner for New Mexico or the commissioner for Colorado, or both, in writing prior to commencement of such operation.

(d) All reservoirs of the Middle Rio Grande project will be operated at all times in the manner described above in conformity with the Rio Grande compact, and no departure from the foregoing operation schedule will be made

except with the advice and consent of the Rio Grande Compact Commission: *Provided,* That whenever the Corps of Engineers determines that an emergency exist affecting the safety of major structures or endangering life and shall so advise the Rio Grande Compact Commission in writing these rules of operation may be suspended

during the period of and to the extent required by such emergency.

(e) The foregoing regulations shall not apply to storage capacity which may be allocated to permanent pools for recreation and fish and wildlife propagation: Provided, That the water required to fill and maintain such pools is obtained from sources entirely outside the drainage basin of the Rio Grande.

LAWS OF THE 88th CONGRESS--S. 614, March 26, 1964

PUBLIC LAW 88-293
[H. R. 1232; 3194]

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled. That the proviso to subdivision (e) of the conditions applicable to the project for improvement of the Rio Grande Basin authorized by section 203 of the Flood Control Act of 1960 (Public Law 86-645; 74 Stat. 493), is hereby supplemented to authorize, for conservation and development of fish and wildlife resources and for recreation, approximately fifty thousand acre-feet of water for the initial filling of a permanent pool of one thousand two hundred surface acres in Cochiti Reservoir, and thereafter sufficient water annually to offset the evaporation from such area, to be made available by the Secretary of the Interior from water diverted into the Rio Grande Basin by the works authorized by section 8 of the Act of June 13, 1962 (Public Law 87-483, 76 Stat. 97), subject to the conditions specified in sections 8, 12, 13, 14, and 16 of said Act. An appropriate share of the costs of said works shall be reallocated to recreation and fish and wildlife, and said allocation, which shall not exceed $3,000,000, shall be nonreimbursable and nonreturnable.

Sec. 2. Nothing contained in this Act shall be construed to increase the amount heretofore authorized to be appropriated for construction of the Colorado River storage or any of its units.

Note: Public Law 87-483 refers to the San Juan -Chama unit of the Colorado River storage project.

APPENDIX B

COMMENTS ON DRAFT ENVIRONMENTAL ASSESSMENT

APPENDIX C

Memorandum of Understanding
Regarding Endangered Species Conservation Pool

The State of New Mexico ("New Mexico"), acting through the New Mexico Interstate Stream Commission ("Commission") and the New Mexico Attorney General, and the United States of America ("United States"), acting through the Army Corps of Engineers ("Corps") and the Department of the Interior Bureau of Reclamation ("Reclamation") hereby agree that:

WHEREAS, litigation under the federal Endangered Species Act ("ESA"), styled *Minnow v. Martinez,* was initiated in late 1999 on the middle Rio Grande in New Mexico seeking protection for the endangered Rio Grande silvery minnow and Southwestern willow flycatcher; and

WHEREAS, Reclamation, in cooperation with other entities, obtained and provided in excess of 168,000 acre-feet ("AF") of stored water to allow continuous flow in the middle Rio Grande for the silvery minnow and for irrigation purposes in 2000; and

WHEREAS, these extraordinary water operations in combination with favorable precipitation during the fall of 2000 resulted in a 100,000 AF addition to New Mexico's accrued Rio Grande Compact credit; and

WHEREAS, the water rights in the Rio Grande Basin have not been adjudicated and the extent of claims to Rio Grande water by third parties are uncertain; and

WHEREAS, New Mexico has recently proposed, as part of an offer of settlement of *Minnow v. Martinez*, to make available for use by the United States, for a period of three years, 100,000 AF of New Mexico's native Rio Grande water and to establish a Middle Rio Grande Endangered Species Conservation Pool ("Conservation Pool") in the Corps' Middle Rio Grande Project Reservoirs; and

WHEREAS, New Mexico proposes, subject to the approval of the Rio Grande Compact Commission, to establish the Conservation Pool during 2001 through 2003 with native Rio Grande water ("Conservation Water") that otherwise would have flowed downstream to Elephant Butte Reservoir and contributed to New Mexico's Rio Grande Compact delivery; and

WHEREAS, New Mexico and the United States contemplate entering into a later agreement ("Conservation Water Agreement") which will, among other things, provide for the release of Conservation Water for the benefit of the endangered species and address ESA issues upon completion of ESA consultation with the Fish and Wildlife Service; and

WHEREAS, Reclamation conducts reservoir accounting for the Corps' middle Rio Grande reservoirs, and that accounting information is used for Rio Grande Compact annual accounting purposes.

NOW, THEREFORE, NEW MEXICO AND THE UNITED STATES AGREE THAT:

1. Upon the completion of all necessary approvals and regulatory requirements, New Mexico will establish the Conservation Pool, and the Corps will seek to capture and store up to 100,000 AF of Conservation Water in the Conservation Pool, subject to the prior approval of the Interstate Stream Commission of each change in reservoir operations that arises from this Memorandum of Understanding ("MOU");

2. The signatories will cooperate in good faith to obtain all necessary approvals and meet all necessary regulatory requirements as quickly as possible;

3. Conservation Water stored pursuant to this MOU will remain in storage, unless and until such water is made available for use by the United States pursuant to the contemplated Conservation Water Agreement. In the event that the Conservation Water Agreement is not executed prior to June 30, 2001, the United States agrees that it will release the Conservation Water to the Rio Grande between November 1, 2001 and March 1, 2002, at times and in quantities as specified by New Mexico.

4. Reclamation will perform hydrologic accounting for all reservoir operations pursuant to this MOU.

5. Nothing in this MOU shall affect or be construed or applied in a manner which is inconsistent with New Mexico or federal law. Nothing in this MOU shall be construed as an admission or concession of any issue of fact or law.

6. This MOU shall expire on the earlier of March 1, 2002, or the effective date of the Conservation Water Agreement. This MOU may be executed in multiple counterparts and shall be effective upon execution by all parties.

United States Corps of Engineers
Dated: April ____, 2001

_____
Raymond G. Midkiff, District Engineer
Lieutenant Colonel, EN
Albuquerque District

United States Bureau of Reclamation
Dated: April ____, 2001

_____
William Rinne, Acting Area Manager
Albuquerque Area Office

New Mexico Interstate Stream Commission
Dated: April ____, 2001

_____
Richard P. Cheney, Chairman

New Mexico Attorney General
Dated: April ____, 2001

_____
Patricia A. Madrid, Attorney General
Stephen R. Farris, Assistant Attorney General